Fall 2017

LSU Research Fall 2017

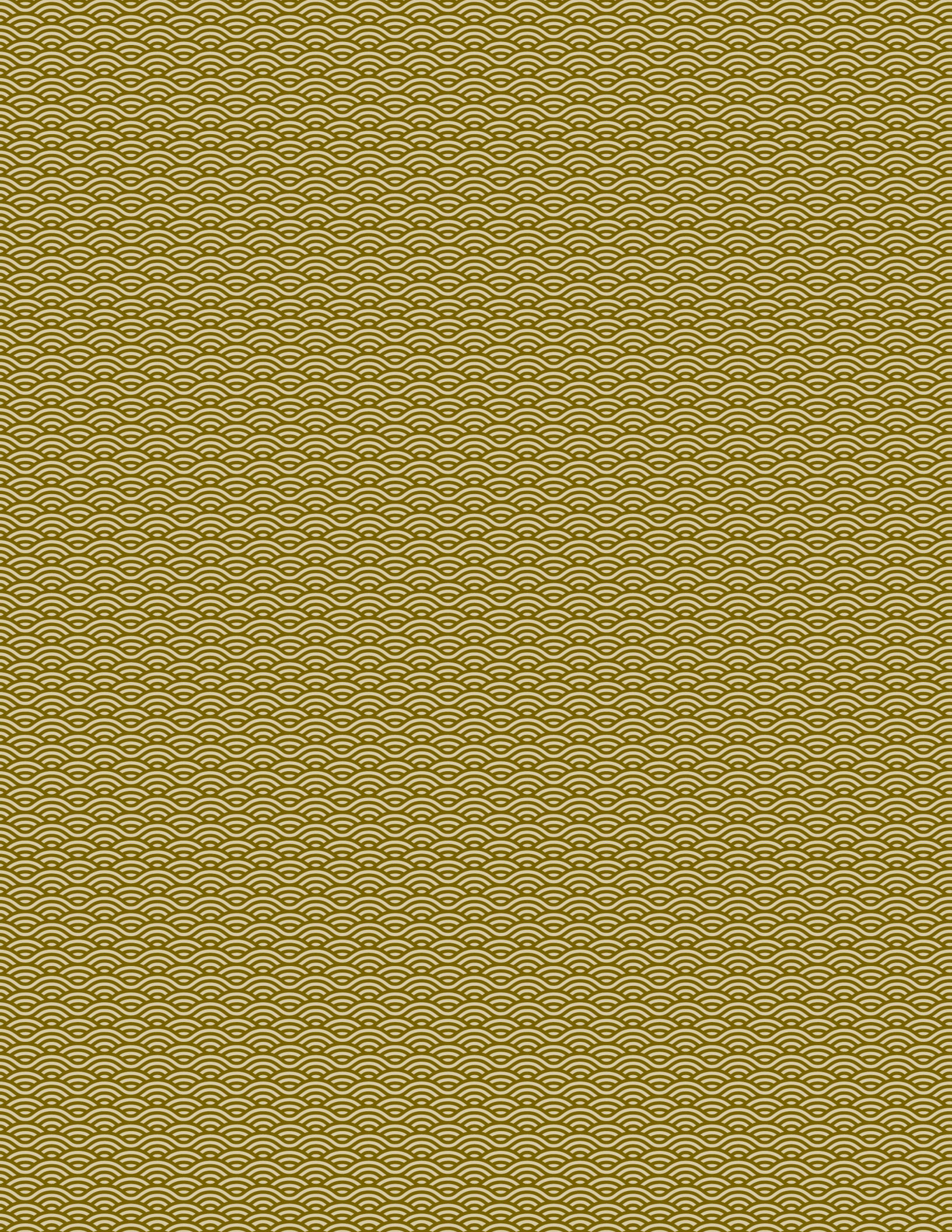
Louisiana State University and Agricultural & Mechanical College

LSU RESEARCH

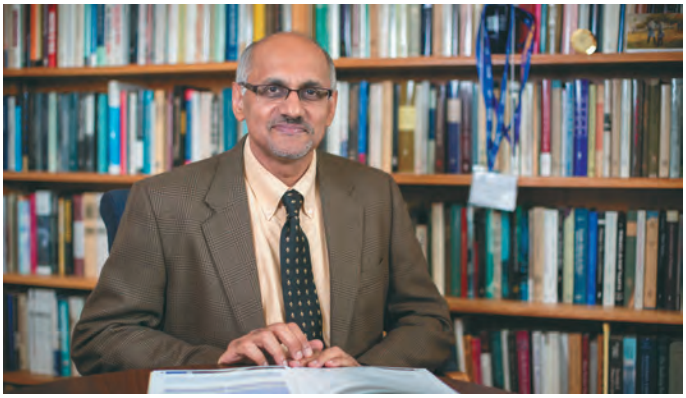
Office of Research & Economic Development ····· The Constant Pursuit of Discovery | 2017-18

WATER

water, water everywhere...



COVER FEATURE



FROM THE VICE PRESIDENT

The resilience of our research faculty and community as a whole shone through during the historic flooding that occurred in Baton Rouge in 2016 and Houston in 2017. Record rainfalls that seem like one-time events signal a change that is occurring worldwide. These events and our on-going international research inspired this year's Water issue of *LSU Research*.

We present the latest findings on which counties in the U.S. are the most vulnerable to flooding. You will also read about developing sustainable buildings meant to withstand and co-habit the dynamic environment. Meet a young researcher who is documenting the stories of people living in coastal Louisiana, which is diminishing at a faster rate than other U.S. coastal communities. These stories and many more highlight some of the best in research at LSU. Resilient and generous, it seems as though our best selves are brought to light in the face of adversity.

I hope you will enjoy the stories and information about our research. For more details and content, please visit our website, **LSU.edu/research**.

Kalliat T. Valsaraj

Vice President, Research & Economic Development
Charles and Hilda Roddey Distinguished Professor of Chemical Engineering
Ike East Professor of Chemical Engineering

ABOUT THIS ISSUE

LSU Research is published annually by the Office of Research & Economic Development, Louisiana State University, with editorial offices in 134 David. F. Boyd Hall, LSU, Baton Rouge, LA 70803.

Send correspondence to the Office of Research & Economic Development at the address above or email research@lsu.edu. Phone: 225-578-5833. Visit us at: **LSU.edu/research**. For more great research stories, visit: **LSU.edu/research/news**.

LSU Research

Publisher and Executive Editor: Stephen David Beck
Editor: Alison Lee Satake
Coordinators: Holly Carruth and Stephanie Shedd
Contributing Writers: Beth Carter, Jayce Genco, Paige Jarreau, Abby Jennings, Nina Lam, Stephanie Malin, Jeff Moulton, Alison Lee Satake, Ellen Smith, and Christine Wendling.
Design: STUN Design & Interactive
Photographers: Eddy Perez and Cody Willhite/LSU Division of Strategic Communications

About the Cover

The cover image is by Justin Patin, a Baton Rouge-based photographer and current LSU student pursuing his Bachelor of Fine Arts degree. This image titled, "Fausse," was taken along a swampy shoreline in the southern part of Lake Fausse Pointe in Iberia Parish at night. The camera was set up in the mud where the swamp meets the lake.

"I took multiple exposures, using an aerial light attached to a drone to illuminate each section of the photograph. After I was satisfied I had enough exposures, I compiled them together in post-editing to create a single illuminated image," Patin said.

He specializes in aerial and land-based landscape, nature, wildlife, and documentary photography. He is also an experienced helicopter and drone pilot.

"By using this new technology and the editing process, I'm trying to show Louisiana's landscapes in a different perspective," he said about this image, which is part of a series called Hidden Louisiana.

Credit: Justin Patin, Rose One Studios, www.roseonestudios.com

LSU IS AN EQUAL OPPORTUNITY/ACCESS UNIVERSITY
Produced by the LSU Division of Strategic Communications
353-0035 • 1.6M • 10/17

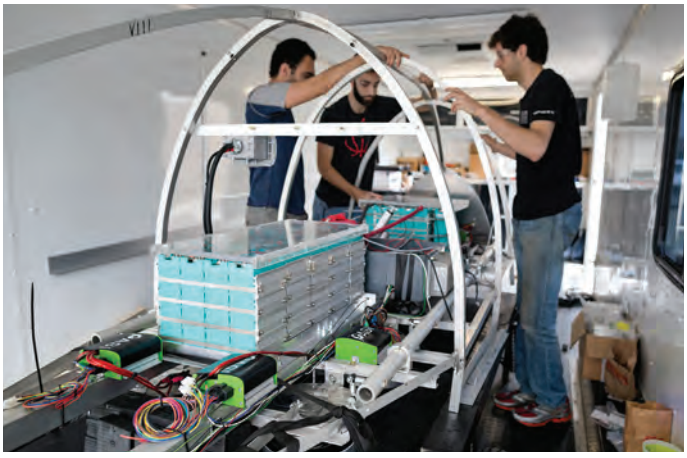
NEWS

Zipping Passengers through High-Speed Travel

By Beth Carter

Imagine floating in a tube at 500 to 600 miles per hour and reducing your commute by a third. A team of LSU students created a new transportation prototype, a pod that could cut travel time. The LSU team tested its invention on SpaceX's Hyperloop test track in Hawthorne, Calif. earlier this year. The team's dream is to build a Hyperloop tube that could run between Baton Rouge and New Orleans, reducing the commute from more than an hour to 20 minutes.

Hyperloop is a concept for a high-speed transportation system created by SpaceX founder Elon Musk. LSU's Hyperloop Team was one of only 30 teams picked from more than 1,000 applicants worldwide to test their prototype in SpaceX's Hyperloop competition.



Credit: Cody Willihite, LSU

LSU Hyperloop team includes (left to right) Connor Joslin, Girguis Sedky, Ross Armond, and Kristopher Meche.

> "The LSU team's technology is more than theoretical and has the potential to be built to full-scale."
>
> —Connor Joslin
> LSU Hyperloop Team lead engineer

The team consisted of 32 LSU students from physics, finance, and engineering majors. The team built the pod with support from Louisiana businesses and the university, as well as faculty advisor and Department of Civil & Environmental Engineering Assistant Professor Aly-Mousaad Aly.

"It's something more than just building some backyard science project. It's something we're building for Louisiana, to boost our education, and to help the community," said Connor Joslin, the team's lead engineer.

Scientists Discover a Way to Sequence DNA of Rare Animals

By Ellen Smith

Scientists have not been able to effectively sequence the DNA of rare or extinct animals from historic museum specimens until now.

"Natural history museums are repositories for extinct species. Unfortunately, naturalists in the 1800s were not collecting specimens for analyses we conduct today such as DNA sequencing. Now with new methods, we can get the DNA from these very old specimens and sequence extinct species like the Ivory Billed Woodpecker, the Tasmanian Wolf, and the Dodo Bird," said LSU Museum of Natural Science Herpetology Curator and Department of Biological Sciences Professor Christopher Austin.

Credit: Eddy Perez, LSU

LSU Museum of Natural Science Curator Chris Austin developed and tested a protocol to sequence the DNA of rare and even extinct animals from historic museum collections.

Over time, DNA degrades and splits into small fragments. This fragmented DNA is difficult to amplify into long informative stretches of DNA that can be used to examine evolutionary relationships among species when using older DNA sequencing technology.

Austin and collaborator Rutgers-Newark Assistant Professor Sara Ruane developed a protocol and tested a method for DNA sequencing thousands of genes from intractable snake specimens. The approach includes taking a small piece of liver tissue from the snake specimen, heating it up over a longer period of time, and applying an enzyme that digests the tissue sample and enables the DNA to be extracted. This minimally invasive protocol preserves the specimen so additional information can be collected from the specimen in the future. It also includes applying the latest technology to chemically sequence the specimens' DNA.

"The exciting thing about this work is that it makes species that have been essentially lost to science, due to extirpation, rarity, or general secretiveness, which applies to many animals and not just snakes, available for scientific research in the modern age of genomics," Ruane said.

The researchers extracted and sequenced the DNA of 13 historic or rare snake specimens from all over the world many of which had never been analyzed using modern genetic methods. Some of the specimens were more than 100 years old. They also integrated these data with modern samples to create a phylogeny that maps the evolutionary relationships of various snake species. This work resulted in thousands of genetic markers for snake specimens collected as far back as the early 1900s.

"We also believe this research will benefit scientists working with rare animals that are either hard to collect or extinct but are represented in fluid-preserved historical collections. It also underscores the continued importance of museum collections in modern science," Austin said.

Study Shines Light on Photosynthesis

By Paige Jarreau

Scientists have solved a longstanding mystery in photosynthesis. Until now, no one knew why one of the vital players in photosynthesis, a protein complex called Photosystem II, essentially paralyzes itself by producing harmful chemicals known as reactive oxygen species. The damage to the plant has significant economic impacts for society including up to a 20 percent reduction in productivity over the course of a few hours of photosynthesis during daylight hours.

Credit: LSU

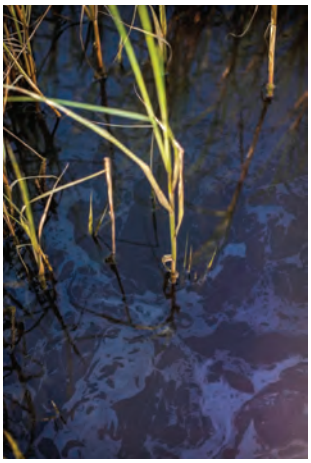
LSU Biological Sciences Professor Terry Bricker and colleagues have solved a longstanding mystery in photosynthesis.

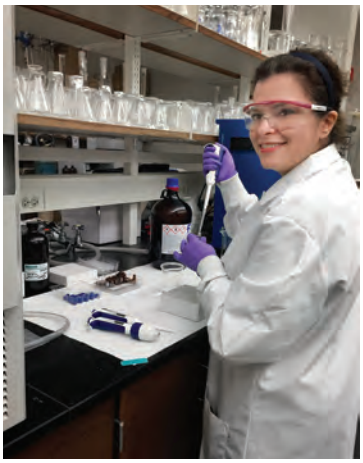
"Photosystem II is part of the electron transport system that makes the oxygen in plants," said Terry Bricker, Moreland Family Professor in the LSU Department of Biological Sciences and lead author of the study. "But it has a problem. Because of the chemistry that this protein complex performs in making oxygen gas, it generates reactive oxygen species, such as hydrogen peroxide, that are damaging to proteins. While Photosystem II produces oxygen, it's also damaging itself in the process."

In a study published in the Proceedings of the National Academy of Sciences, Bricker and colleagues at LSU, the Palacký University in the Czech Republic, and at the University of Cincinnati in Ohio identified the specific regions of the Photosystem II protein complex where these reactive oxygen species wreak havoc. They also found that a hydroxyl radical and a superoxide, types of reactive oxygen species, are guilty of damaging Photosystem II during photosynthesis. Lastly, they were able to locate the areas in Photosystem II most susceptible to damage by taking spinach leaf extracts and exposing them to bright sunlight for several hours.

"We were able to watch as Photosystem II was damaged, by monitoring its activity over time," Bricker said. "At specific intervals, we went in and analyzed Photosystem II proteins using mass spectrometry, to find out which amino acids were being modified. We found that amino acid residues near where oxygen is created by Photosystem II are damaged first. Sometime later, damage occurs along the electron transport chain carrying electrons away from the site of oxygen production."

Plants can lose up to a 20 percent loss in productivity from damage caused by Photosystem II.





Credit: Andrea Bonisoli Alquati, Cal Poly Pomona

LSU Department of Environmental Sciences Ph.D. graduate Parichehr Saranjampour studied how crude oil and diesel fuel chemicals interact with the environment.

Research Shows Crude Oil Chemicals Move and Change More Quickly than EPA Standards

By Jayce Genco

The Environmental Protection Agency, or EPA, lists about 65 chemicals as "toxic pollutants" under the Clean Water Act, 16 of which are polycyclic aromatic hydrocarbons, or PAHs. LSU Department of Environmental Sciences Ph.D. graduate Parichehr Saranjampour conducted research on a chemical class of PAHs that is not on the EPA's list — Dibenzothiophene, or DBT.

DBT and its three related chemical compounds contain sulfur that is found in crude oil. Saranjampour studied how these chemical compounds move and change over time, which revealed new information that has never been published before. Her findings differ from the EPA's information about these chemical compounds.

Saranjampour studied two processes that chemicals undergo — evaporation and oxidation, or what happens when something is exposed to light and air. From lab experiments, she found that one compound oxidized faster than the currently accepted rate relative to the four compounds. She also found that another compound evaporates and is released into the air faster than previously thought, which may have implications on land animals as well as humans who come into contact with oil, including oil rig workers.

These chemicals are not only found after a crude oil spill, but they can also be found in water and sediment where crude oil or diesel fuel are present. She is currently investigating the toxicity of these chemical compounds.

"These results call for more research by environmental chemists and toxicologists to investigate the environmental impacts of these chemicals in water, sediment, air, and on living organisms," she said.

Deepwater Horizon Oil Found in Land Animals

By Staff Reports

Credit: Philip Stouffer, LSU School of Renewable Natural Resources.

LSU graduate student Allison Snider conducts research on Seaside Sparrows that reside in Louisiana marshes year-round. New research shows Deepwater Horizon oil in these native birds.

Scientists have identified the first evidence of Deepwater Horizon oil in a land animal — the Seaside Sparrow. The scientists analyzed the diet and feathers of sparrows collected more than a year after the oil spill. The birds that were captured in habitats that were exposed to the oil had a different chemical signature in their tissues than the birds that were found in areas of the marsh that were not exposed to the oil. The scientists' results show that the oil from the Deepwater Horizon oil spill was incorporated into the prey and feathers of the exposed birds.

"We know that carbon from oil entered the offshore and nearshore food webs as demonstrated for plankton, fish, and filter feeders. But this is the first demonstration that carbon from oil was also integrated into a terrestrial vertebrate species, the Seaside Sparrow," said LSU School of Renewable Natural Resources Associate Professor Sabrina Taylor.

The Seaside Sparrow is a year-round resident of Louisiana marshes. The study suggests that direct exposure to the toxic oil may have been detrimental to the birds' reproductive success.

"These results suggest that the differences we have observed in sparrow gene expression and reproductive success between oiled and unoiled sites may be caused by direct toxicological effects not just habitat degradation or loss of prey species," she said. ■

Credit: Len Apcar, LSU

Len Apcar and his Media Writing class celebrate the end of the semester with a trip to the LSU Dairy Store.

Len Apcar

Q&A with the LSU Manship School of Mass Communication Wendell Gray Switzer Jr. Endowed Chair in Media Literacy

By Beth Carter

Credit: LSU

Len Apcar has more than 40 years of experience in the field of journalism and mass media. He built his professional career at some of the nation's most prestigious news organizations, including 24 years at The New York Times and 12 years at The Wall Street Journal. In that time, he worked as a reporter, Washington D.C. senior editor, and editor-in-chief for the New York Times' Asia newsroom in Hong Kong. He was also the editor of nytimes.com. He joined the faculty at LSU in 2015. Apcar holds a bachelor's degree in political science from Claremont McKenna College in Claremont, Calif. as well as a master's degree from Columbia University's journalism school in New York City. At LSU, he is a fellow at the Reilly Center for Media & Public Affairs and teaches media management, political communication, and media writing.

What originally drew you to LSU?

Long before I considered teaching here, I visited the campus to offer a lecture or two and was impressed. Students, faculty, and staff seemed happy. I could tell that students wanted to be here and were eager to learn. I loved the obvious beauty

Credit: LSU

At Tiger Stadium with student athlete Blake Ferguson.

of the campus, the trees, and buildings. It all had a good feel to it. Manship emphasized media and public policy and had accomplished a great deal with its Reilly Center conferences and Breaux symposiums. I spent my career mostly in public policy journalism and I liked all of that and wanted to do more.

What are some similarities and differences between working in a newsroom versus a classroom?

Reporting and editing reflect a lot of teaching and research. Reporters gather data and information, distill it, and explain it in an accessible way. There is a lot of teaching in that. Similarly, as an editor, I worked with a lot of reporters, who wanted to learn and improve their skills, or some who wanted help thinking through a problem or a story. All of that is similar to the student-professor relationship.

The pace at The Times is different than LSU. The competitive pressure in journalism is constant for the breaking story, the tip, even for the biggest projects and investigations. The newsroom is also feeling the unrelenting force of disruption in how readers and advertisers use media. The change internally is profound and at times wearing. Add the Trump administration's penchant for constant news, and you have days and weeks that are exhausting, competitive, and exhilarating when you do good work.

LSU faces lots of competitive pressures and challenges. But our intellectual assembly line produces a great project in four years, not four hours!

What are you most proud to have accomplished at the LSU Manship School of Mass Communication and what are some of your goals for the school?

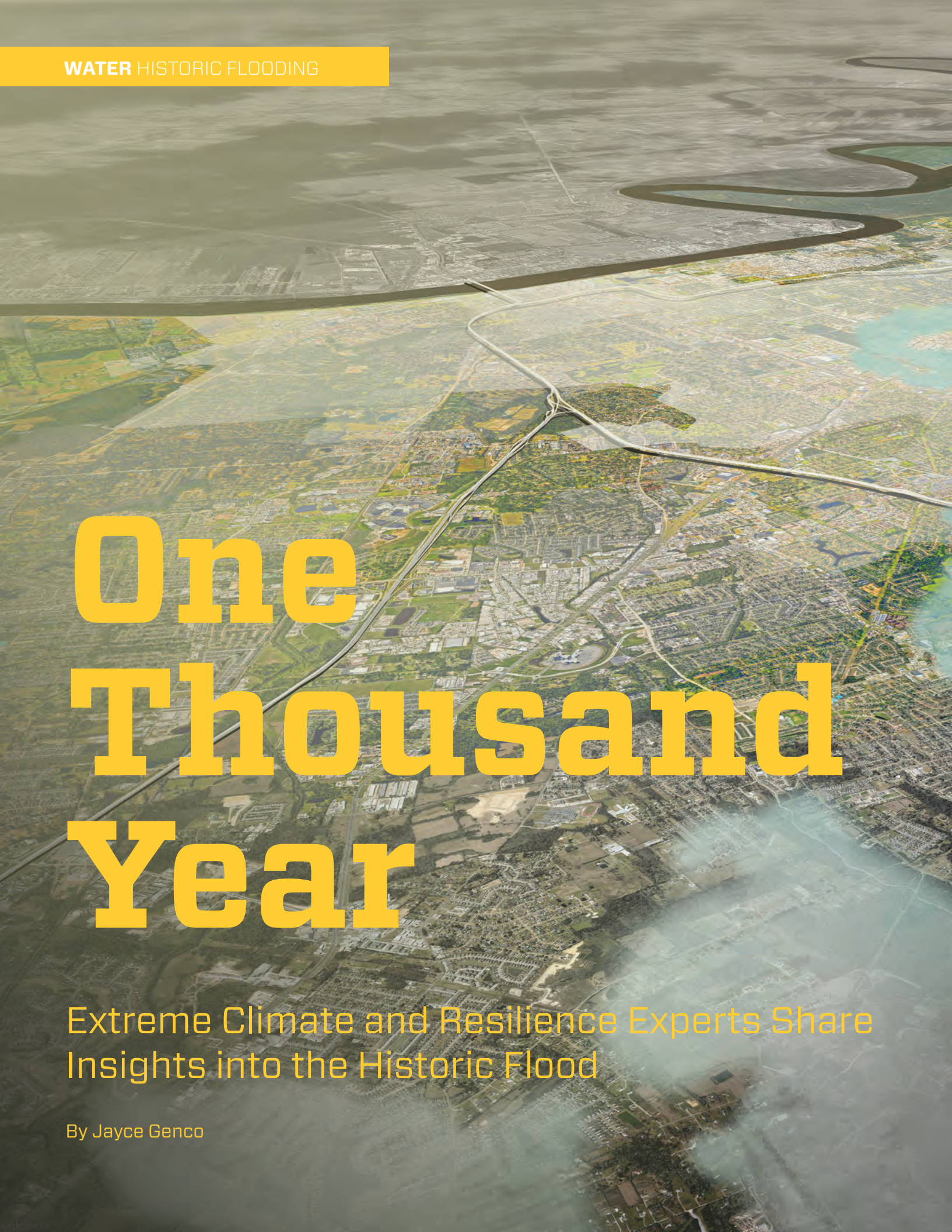
A part of media literacy is knowing how to evaluate information to understand issues. Our evening program on Fake News last spring was a huge hit with students and the community. More than 5,000 people participated in solvethebudget.org, an interactive survey on the state's fiscal problems this year, which explained a lot about taxes and spending. We hope to do more with both of those. Overall, I want Manship graduates to be smart about how to assess information, advertising, PR, and journalism. I would like them to read a story and spot the biases, sexism, the lack of attribution, flimsy sourcing and most all, just plain bad work. And, I'd like them to celebrate truly great work, too.

Why do you think media literacy is important and that people learn how to navigate the ever-changing way they receive news and information?

Information will be a constant in our lives. It is crucial to the democratic process. We need to be skilled editors about what we read and what we make of it. The Founding Fathers knew this and it is true today. Knowledge will forever govern ignorance.

What are some of your favorite aspects of life at LSU?

LSU has wonderful academic depth and institutional pride. That is fun, so are the mild winters, the smart, enthusiastic students — and football tailgating. ■



One Thousand Year

Extreme Climate and Resilience Experts Share Insights into the Historic Flood

By Jayce Genco

LSU Coastal Sustainability Studio rendered this perspective map of the Greater Baton Rouge area.

Credit: LSU Coastal Sustainability Studio

The city of Baton Rouge sits on the banks of the Mississippi River. The capital city was a place of refuge for people displaced by storms such as Hurricane Katrina. In August 2016, thousands of residents' homes were inundated by an historic flood event.

Credit: LSU

It was like any other hot, humid August day in south Louisiana. The chance of afternoon thunderstorms was welcome to briefly cool off the terrain and provide some relief from the smothering heat.

Louisiana State Climatologist and LSU Geography & Anthropology Professor Barry Keim was enjoying the 2016 Rio De Janeiro Summer Olympics on television with his family when the thunderstorms began Thursday afternoon. The afternoon storms intensified into the night of Aug. 11, 2016.

"We went to bed and I was contemplating and wondering whether we were going to go to New Orleans the next day as we had planned. But I woke up on Friday morning and immediately decided that we were not going," Keim said. "I went and checked the data from the Baton Rouge Airport and it showed that it had rained every hour throughout the night."

The storm situated itself just over North Baton Rouge on Friday, causing the low-lying areas around Baton Rouge to flood. Keim and a graduate student began taking pictures and documenting the early flooding around the LSU area.

"As the day played out on Friday, it literally rained every waking minute of the day. I personally don't ever remember to when it has rained every minute of the day," Keim said. "It was never not raining."

The system pummeled the region well into Saturday and after three days of persistent rain, the downpour stopped. Even though the rain around the Baton Rouge area ceased, the storm system slowly crept toward southwestern Louisiana and the torrential rains continued.

The unnamed storm system began as an area of high pressure that turned into a meteorological trough of instability off of the Florida panhandle on Aug. 3. By Aug. 4, the system had transformed into a tropical wave, which is a cluster of thunderstorms not quite strong enough to be deemed a tropical depression by the National Hurricane Center.

On August 5, the National Hurricane Center believed the tropical wave moving slowly across the Florida panhandle had a 20 percent chance of becoming a hurricane. The storm began to gradually move across the Gulf Coast region until it eventually dumped nearly 7.1 trillion gallons of water on south Louisiana over three days.

"Most of the heavy rainfalls that we have here in Louisiana are produced by tropical storms or hurricanes or very strong frontal

Some of the heaviest hit areas in Baton Rouge and the surrounding parishes received more than 31 inches of rain over three days.

Credit: LSU

systems that sweep in across the country," Keim said. "To have a tremendous, record-setting rain event from a tropical wave, I would say, is unprecedented."

For the Greater Baton Rouge area, the 100-year two-day rainfall event threshold is 14.02 inches of rain while the 1,000-year threshold is 21.23 inches. Rainfall during the historic August 2016 floods measured in at about 31.39 inches of rain in some of the heaviest hit areas.

"There was really no single hour or six-hour, or 24-hour period that was hellaciously impressive. The two day and longer rain durations were off the charts," Keim said. "This was the biggest, most prolific rain producing system we've ever had in the state."

According to Keim, many weather stations in Greater Baton Rouge measured right around a 100-year event, but nine stations measured at a 1,000-year event and 11 stations measured more than 20 inches of rain.

As the rain battered the region for three straight days, the waters of south Louisiana's many rivers, tributaries, and bayous quickly began to rise, wreaking havoc on the unprepared citizens of East Baton Rouge, Ascension, Livingston, St. Helena, and Tangipahoa parishes. The flooding affected about 500,000 people, flooded 146,000 homes, claimed 13 lives, and cost billions of dollars in economic damages.

Louisiana's low landscape coupled with continuous rain caused areas that were not in a flood plain and had no record of previous flooding to become swamped in several feet of water without any prior warning. Geography & Anthropology doctoral candidate and Baton Rouge native Clay Tucker said the heavy rainfall and subsequent flooding mostly hit areas with higher elevation, but eventually the water flooded low-lying areas as well.

"One of the interesting things about Louisiana is that because it's so flat, [water] builds up like a bathtub instead of running off," Tucker said. "We have a really big north-to-south gradient of elevation change —hundreds of feet of change. All of the rain has to come down hill, so the areas with low elevation held the water for a really long time and stayed flooded for weeks."

> "It literally rained every waking minute of the day."
>
> —Barry Keim
> LSU Geography & Anthropology professor

Credit: LSU

The August 2016 floods affected about 500,000 people, flooded 146,000 homes, claimed 13 lives, and cost billions of dollars in economic damages.

Credit: Barry Keim, LSU

Louisiana State Climatologist and LSU Geography & Anthropology Professor Barry Keim documented the flooding around LSU in August 2016.

Lessons Learned

Jeffrey Carney, associate professor in the School of Architecture and director of the LSU Coastal Sustainability Studio, is working with coastal scientists, civil engineers, landscape architects, architects, and social scientists to address some of the problems with Louisiana's low-lying residential and economic areas.

"We've spent the last decade building tremendous capacity along the coast to model, observe, project future scenarios, understand the landscape, and understand the flow of water and storm surge. All of these are really tremendous, but we don't have nearly as much information available for upstream," Carney said. "One thing that we've learned is that Baton Rouge doesn't have a good handle on its hydrology."

The rapid economic growth in the area has increased the number of impervious surfaces, which has changed the landscape. However, it's not well known how these changes affect us.

The research group works with government officials from cities, towns, and municipalities on transforming neighborhoods affected by flooding into sustainable neighborhoods, while updating flood maps and learning the landscape to prevent future water damage.

"I think what we've learned is that we lack the data and the knowledge and the real understanding of how the system works to adequately protect ourselves. There's a real need for a much stronger understanding of the landscape and how it functions," Carney said. ■

Credit: Madelyn Smith and Trent Andrus

Allie "Gator" is the weekend night doorman of the Jolly Inn, one of the last Cajun dance halls remaining in Houma, La.

LOUISIANA GONE

By Beth Carter

In a new book, *Louisiana Gone*, LSU Natural Resource Ecology & Management student Madelyn Smith ('19) puts a personal spin on one of Louisiana's biggest environmental challenges: coastal land loss.

Smith, a Lafayette, La. native specializing in conservation biology, recently published a compilation of stories and photos from residents living in some of the state's most vulnerable coastal regions.

Smith first became interested in coastal conservation after taking a class through the Roger Hadfield Ogden Honors College during her freshman year. She then received a grant from the Honors College to pursue a project with a societal benefit. The grant, named the Leader Scholarship, gives students a $5,000 stipend to research a project with significance to Louisiana.

According to the U.S. Geological Survey, the state of Louisiana loses approximately 17 square miles of wetlands every year, or a football field's worth of land every hour. Since 1932, Louisiana has lost enough land to equal the size of Delaware – approximately 2,500 square miles.

Louisiana Gone started as a website by Smith and fellow student Trent Andrus ('18), a mechanical engineering major, to help document the effects of land loss in coastal communities such as Cutoff, Morgan City, Houma, and Leeville, La. It features personal stories of coastal residents accompanied by black and white still photos of their neighborhoods and towns. This year, Smith took the next step in her project: creating a book based off of the stories on the website. Since the book was published earlier this year, it has sold around 50 copies.

Credit: Cody Willhite, LSU

Madelyn Smith authored a compilation of stories and images of people affected by coastal land loss in her new book, *Louisiana Gone*.

Smith says she reached out to friends in order to find potential interviewees. She also looked up local business owners and even just stopped people on the street to get their take on Louisiana's land loss. Overall, she and Andrus interviewed more than 25 people from various towns and communities. She discovered that the relationship between oil companies and the locals is often more complex than it appears.

"For a lot of these people, the two aren't black or white," Smith said. "Everyone knows someone who works in the oil business, and everyone knows someone who's a local fisherman. It's easy to demonize oil companies from afar, but the reality is that they're intertwined with these towns and these people."

In the fall, Smith will begin an internship with LSU Religious Studies Professor Michael Pasquier to capture oral histories of other locals living on and near the Mississippi River. They plan to distribute these stories as podcasts, which will be available for download by the public.

Smith says by working on this project, she has gotten the opportunity to discover new parts of the state and build a unique connection with her fellow Louisianans.

"Being from Lafayette, I always considered myself kind of a city girl, so I had never really experienced the way of life as some of these communities," she said. "But through *Louisiana Gone*, I've really gotten to experience a completely different side of Louisiana, and I'm just glad I could help tell these stories."

For more info, visit: louisianagone.com.

INLAND FLOOD

Americans Who Live Far from Coasts Should also Be Worried about Flooding

By Nina Lam, Professor & Abraham Distinguished Professor of Louisiana Environmental Studies, LSU Department of Environmental Sciences, College of the Coast & Environment

Catastrophic flooding in Houston from Hurricane Harvey is the latest reminder that floods kill more people in the United States than any other type of natural disaster and are the most common natural disaster worldwide. Many communities along U.S. coastlines have begun to take heed and have slowed development in coastal flood zones. The bad news, as Harvey shows, is that inland communities are also at risk – and in some, development in flood zones is increasing.

In a new study funded by the National Science Foundation, LSU researchers found that inland communities are becoming more vulnerable to flooding than coastal communities, which generally have slowed development in flood zones.

Credit: Nina Lam, LSU

With post-doctoral research associate Yi Qiang and graduate students, I recently studied development patterns in the United States from 2001 to 2011. We found that while new urban development in flood zones near coasts has generally declined, it has grown in inland counties. This is a worrisome trend. It implies that people who have experienced flooding on the coast migrate inland, but may not realize that they are still vulnerable if they relocate to an inland flood zone.

That's what we have seen firsthand here in Louisiana. Thousands of people fled New Orleans after Hurricane Katrina in August 2005 and settled 80 miles inland in Baton Rouge. A decade later, many of these same people lost everything again when a 500-year flood event struck Baton Rouge in August 2016.

Climate change effects, such as sea level rise and potentially more extreme weather, are increasing the risk of flooding, hurricanes, and storm surges in coastal areas. Some communities are considering moving coastal populations inland to protect them. However, our research shows that people should be very careful about moving inland. They can still face flood hazards if their property is located in a high-risk flood zone.

People who have experienced flooding on the coast migrate inland, but may not realize that they are still vulnerable if they relocate to an inland flood zone.

Not Just a Coastal Issue

Flooding can happen wherever large rainstorms stall over an area, as we have seen in Boulder, Colorado in 2013; in Texas and Louisiana in 2016; and over Houston now. However, if communities take steps to reduce flood risk, they can mitigate the danger to people and property.

When we assess flood risk in a given location, we consider three questions.

Hazard: How likely is a flood event?

Exposure: How many people and physical assets are located there?

Vulnerability: Do people have the capacity to deal with the event?

Flood risk is the product of these three elements.

We can decrease flood risk by reducing any of the three elements. For example, communities can reduce hazard by building flood control structures, such as dams and levees. They can use laws and policies, such as land use controls, to reduce exposure by steering housing development away from flood zones. And they can make people and property less vulnerable through other measures, such as elevating houses and developing better flood warning systems and emergency preparedness plans.

How can people learn about flood risks where they live? The Federal Emergency Management Agency has created flood zone maps for most parts of the United States. The maps are based on models that consider factors such as elevation, average rainfall, and whether a location is near a river or lake that could overflow.

FEMA maps classify flood zones into three categories: high-risk, moderate-low risk, and undetermined. High-risk zones have at least a 1 percent chance of being inundated by flood in any given year. These areas are also called base flood or 100-year flood zones.

To obtain a federally insured mortgage on property in a 100-year flood zone, buyers are required to have flood insurance. This policy is designed to make people less vulnerable in the event of a flood, but it increases the cost of home ownership. As a result, flood zone designations can be very contentious.

Moving into Harm's Way

We undertook this study because we wanted to develop a clear baseline showing how Americans' exposure to flood hazards has changed over the past decade. To assess levels of exposure to flood hazards nationwide, we compiled urban development, flood zone, and census data and overlaid them on a county map of the nation.

Overall, we estimated that as of 2011, more than 25 million Americans lived in flood zones. We also found that inland communities were less responsive to flood hazards than coastal communities and were doing a poorer job of steering development out of flood-prone areas.

Credit: Eddy Perez, LSU

LSU Department of Environmental Studies Professor Nina Lam and research colleagues analyzed development patterns in U.S. counties from 2001 to 2011.

Credit: Eddy Perez, LSU

A number of inland counties where the largest share of the total population living in a flood zone increased between 2001 and 2011 are located on rivers.

The three U.S. counties with the largest concentrations of people living in flood zones are located on the Gulf of Mexico. They are Cameron Parish, Louisiana (population 6,401, with 93.6 percent in flood zones); Monroe County, Florida (population 66,804, with 91.4 percent in flood zones); and Galveston County, Texas (population 241,204, with 82.8 percent in flood zones).

Overall, we estimated that as of 2011, more than 25 million Americans lived in flood zones.

These are all coastal communities, where flood risks should be well-known to all residents. But we also found inland counties where the share of the total population living in flood zones increased over the decade we examined. A number of those with the largest increases are bordered by rivers, such as Marshall County in western Kentucky, which sits between Kentucky Lake and the Ohio River. We also identified several hot spots where urban development has increased in coastal flood zones, including New York City and Miami.

Reducing Exposure Now

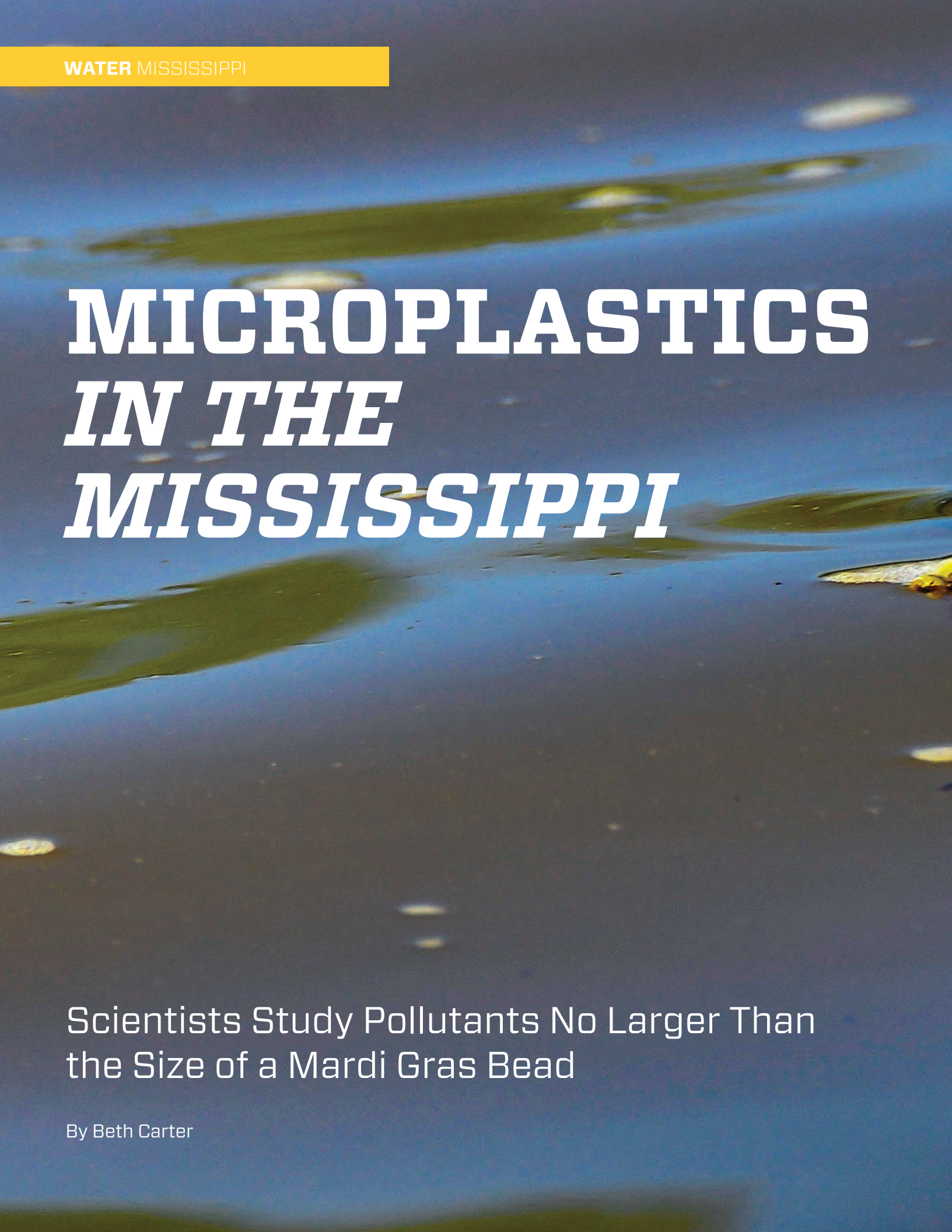
This alarming trend points to a need for more awareness, education, and communication about flood risk, especially in inland counties. More affordable housing in nonflood zones and strategies to mitigate floods are also needed, especially inland.

Why would people move to inland flood zone areas? Some may be unaware of the risk. Others may plan to adapt through steps such as elevating their houses or buying flood insurance. Still others may accept the risk because they want to be closer to relatives or workplaces, or for other cultural, political, or institutional reasons.

Our analysis has pinpointed a number of regions of concern. The next step is to produce in-depth analyses of these regions, in order to understand why people are locating in flood zones there, and to devise local strategies to reduce overall U.S. flood risks. Climate change, land subsidence or sinking, and construction of new levees and dams will change long-term flood exposure in these areas over time. Therefore, local governments, mortgage lenders, and homeowners should review current FEMA flood hazard maps for accuracy.

This research provides national context for a detailed study that we are carrying out examining resilience and sustainability in the Mississippi River Delta. Our goal is to understand how human actions combined with natural environmental conditions may have caused land to sink in the Mississippi Delta. Our research on development in flood zones reminds us that flooding problems in low-lying coastal regions are not unique and also affect areas well away from the shore. ■

This article first appeared in THE CONVERSATION



MICROPLASTICS *IN THE MISSISSIPPI*

Scientists Study Pollutants No Larger Than the Size of a Mardi Gras Bead

By Beth Carter

More than 5 million tons of plastic enter the ocean every year. It's lightweight, durable, and massively produced worldwide, and comprises a large part of all debris found in the ocean. While research and documentation of plastic debris in the world's oceans and surrounding waterways has increased over the past decade, LSU Department Oceanography & Coastal Sciences Professor Mark Benfield and colleagues are the first to survey the amount and type of plastic in the waters of the Gulf of Mexico. This research was published in the journal Environmental Pollution.

Credit: Danielle Dilullo, Louisiana Sea Grant College Program

LSU Department Oceanography & Coastal Sciences Professor Mark Benfield is conducting the first survey of the amount and type of plastic in the Mississippi River and the Gulf of Mexico.

Credit: Roy Kron, Louisiana Sea Grant College Program

The waters of the northern Gulf of Mexico receive input from the Mississippi River, one of the largest river systems in the U.S. Microscopic pieces of plastic no larger than a Mardi Gras bead, or about 5 millimeters, often begin as trash discarded at the beginning of the Mississippi River in Minnesota and get broken down as it travels down to Louisiana. Microplastics can originate from many different sources, including microbeads from face wash, synthetic fabric lint from laundry, rubber tires, and even toothpaste. These tiny shreds of plastic often are similar in size to small marine animals called zooplankton, which fish eat.

"We chose the Mississippi because the high concentrations of microplastics that we found in the Gulf had to come from somewhere."

—Mark Benfield
LSU Department of Oceanography & Coastal Sciences professor

Credit: Danielle Dilullo, Louisiana Sea Grant College Program

Microscopic pieces of plastic no larger than a Mardi Gras bead, or about 5 millimeters, often begin as trash discarded at the beginning of the Mississippi River in Minnesota and get broken down as it travels down to Louisiana and out to the Gulf of Mexico.

Benfield and his colleagues, post-doctoral researchers Matthew Kupchik and Rosana DiMauro, first started researching microplastics in the Gulf of Mexico in 2015. Benfield's team collected samples of seawater by towing a net from the research vessel *Pelican* off the Louisiana coast in the Gulf of Mexico. They collected water samples at four locations in the northern Gulf of Mexico from the surface of the gulf down to about 15 meters deep. Every sample they analyzed contained some kind of microplastic. The study found that the concentration of microplastics in the Gulf was among the highest in the world.

LSU Post-doctoral Researcher Matthew Kupchik deploys a plankton net into the Mississippi River.

> "Given the low population density along the coast, the Mississippi River was the most likely culprit."
>
> —Mark Benfield
> LSU Department of Oceanography & Coastal Sciences professor

Benfield and his team have since expanded their research into the Mississippi River with partial support from the Louisiana Sea Grant College Program.

"We chose the Mississippi because the high concentrations of microplastics that we found in the Gulf had to come from somewhere," Benfield said. "Given the low population density along the coast, the Mississippi River was the most likely culprit."

The Mississippi River drains most of the large, densely populated cities in the central U.S. Therefore, the Mississippi River potentially delivers massive, accumulated quantities of plastic to the Gulf of Mexico.

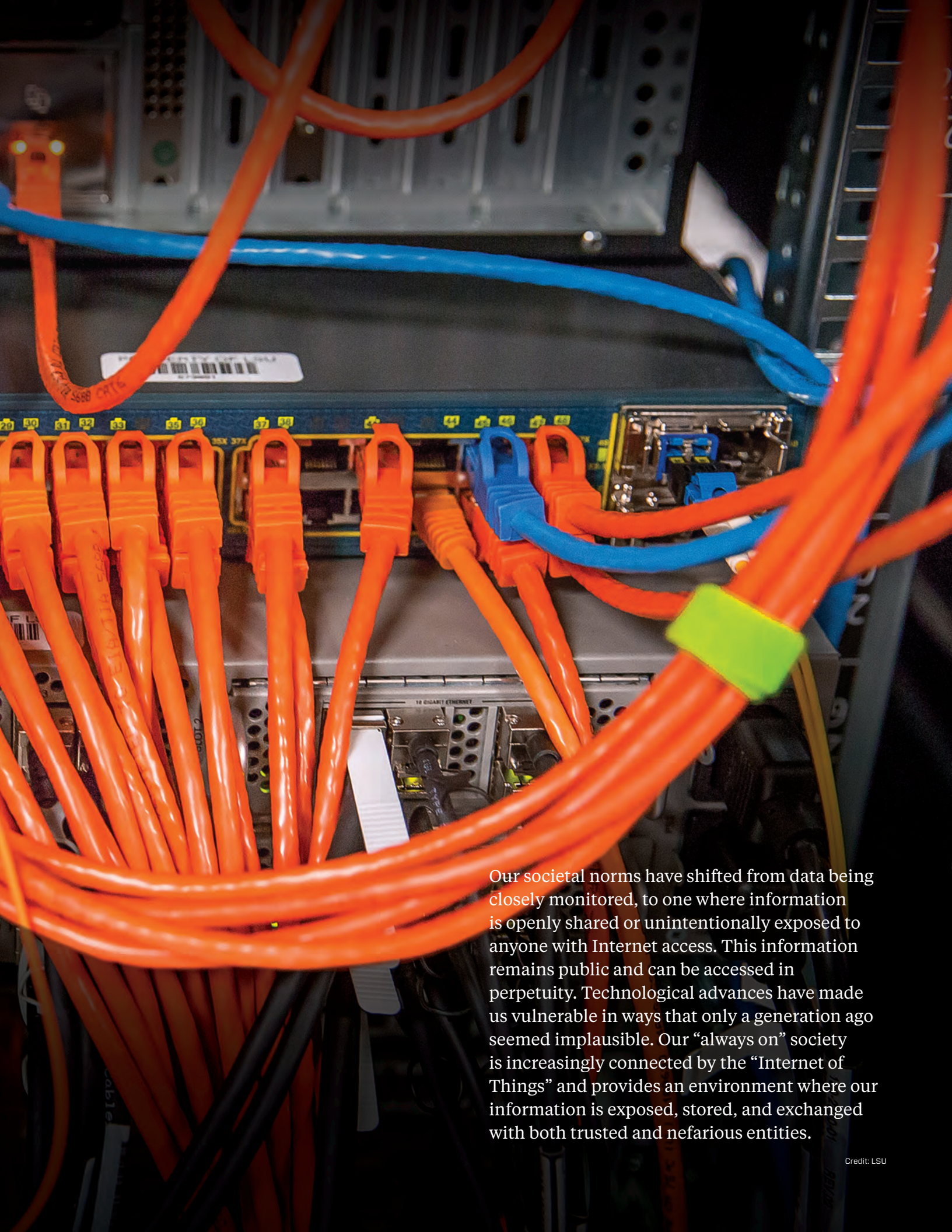
For future research, Benfield wants to find out just how much microplastic flows from the Mississippi to the Gulf of Mexico every year.

"From there, we can try to understand where it is going and what is eating it. Further down the road, we can also examine the implications of microplastic consumption for our coastal ecosystem," he said. ■

CYBER HYGIENE

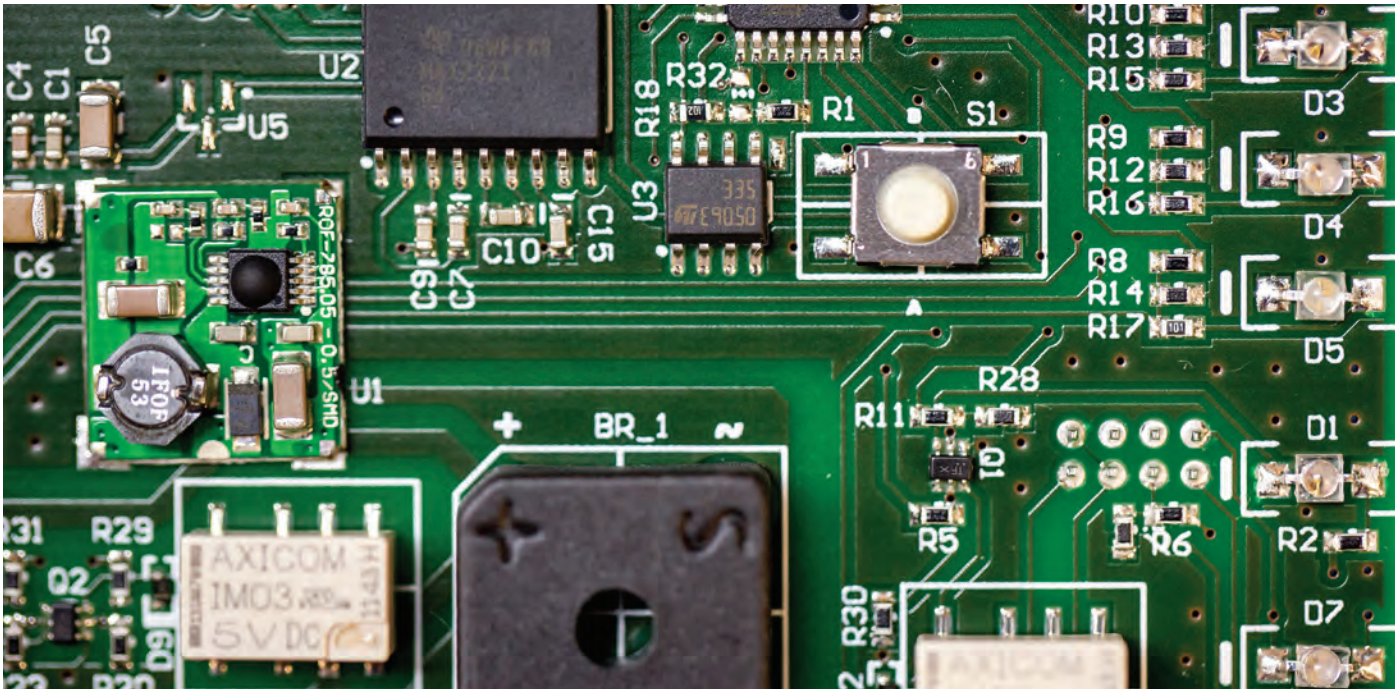
Keeping Your Family Safe in the 21st Century

By Jeff Moulton, Stephenson National Center for Security Research and Training executive director



Our societal norms have shifted from data being closely monitored, to one where information is openly shared or unintentionally exposed to anyone with Internet access. This information remains public and can be accessed in perpetuity. Technological advances have made us vulnerable in ways that only a generation ago seemed implausible. Our “always on” society is increasingly connected by the “Internet of Things” and provides an environment where our information is exposed, stored, and exchanged with both trusted and nefarious entities.

Credit: LSU



Credit: LSU

Cyber attacks are on the rise. We learn daily about identity thefts, hacked cars, stolen healthcare records, and virtual bank heists. These attacks lead to individuals being financially ruined, companies facing economic loss, organizations paying ransoms to unlock data, and governments having sensitive data exposed. We have grown so accustomed to hearing about negative cyber events that we now accept this phenomenon as normal.

Identity theft occurs every two seconds and we should make better security choices to protect our families. According to AllClear ID, children are 35 times more likely to be victims of identity theft than adults. Child identity theft is more prevalent than adult identity theft and usually goes unnoticed because children do not check their digital footprint. Last year, the rate of young identity theft victims doubled and the percentage of victims under the age of five increased by 105 percent. For the thief, the younger the child the better, because it gives the thief more time to operate undetected. As these children grow up and begin to apply for college, purchase a car, look for homes, or try to secure business loans, their credit has been unknowingly destroyed sometime earlier in their young lives.

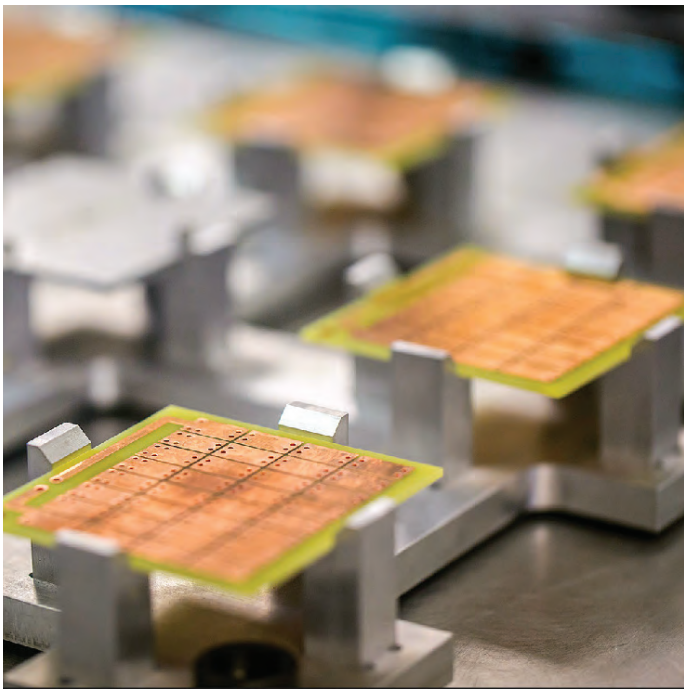
Naiveté, limited parental supervision, and the lack of proper cyber practices are all ingredients leading to a negative cyber incident. So what do we do about it?

For starters, we need to recognize the problem and quit believing it simply won't happen to us. Our digital information is interesting and valuable. Simply recognizing we live in an increasingly connected world is big step. Televisions, refrigerators, even crock pots now have the ability to be networked together. While this offers a tremendous amount of convenience, it also provides unprecedented access to you and your family. The first thing to do is read the fine print. Manufacturers must disclose the details of how products use, store, and transmit your data. We are often too lazy or busy for reading and fail to heed these warnings.

> "Establish separate accounts and passwords for each member of your family, frequently mask and reset your wireless router password, and use a disposable credit card for online purchases."
>
> —Jeff Moulton
> LSU cybersecurity expert

So how do we balance security, convenience, and connectivity? The answer is to employ appropriate cyber hygiene. Cyber hygiene is the establishment and maintenance of an individual's online safety. It is the online equivalent of personal hygiene and encapsulates daily routines with occasional checks and general behaviors to maintain a user's online "health."

Cyber hygiene is personal. Just like the physical world, the digital world requires a degree of hygiene to limit your exposure. Consider influenza, which has been around for



Credit: LSU

hundreds of years. We've learned to employ a variety of hygienic means to limit our exposure. The flu does not infect individuals selectively and neither do viruses in the digital world. Ninety-two percent of identity theft victims did not know anything about the offender, according to the U.S. Department of Justice. We need to apply the same degree of caution we use in our physical health and safety to our digital health and safety.

Cyber hygiene is simple. You need to control what you can and be aware of what you can't. It doesn't require a technical degree, but it does require behavioral changes, commitment, and tailoring to fit your lifestyle. Simple cyber hygiene techniques include: establishing separate accounts and passwords for each member of your family, frequently masking and resetting your wireless router password, and using a disposable credit card for online purchases.

Ubiquitous connectivity coupled with our "always-on" personal devices, set us up for a relentless attack on our information. We need to act responsibly and take steps to limit this exposure. Awareness, action, and effective cyber hygiene is the best strategy to ensure success. Remember, stop-think-then click! ■

About the Author

Jeff Moulton is a cybersecurity expert. He is the executive director of the Stephenson National Center for Security Research and Training, the director of the Transformational Technologies & Cyber Research Center, and an adjunct professor in the LSU College of Engineering. He is a Certified Information Systems Security Professional and holds certifications in Information Systems Security Engineering.

LSU CYBER SECURITY EXPERT DISCUSSES WORLDWIDE CYBERATTACK

By Rachel Spangenthal

Organizations and individuals are now taking a closer look at their cyber security after a worldwide attack on their information. LSU teaches future cybersecurity experts how to prevent these viruses from impacting technology.

"It's literally you're running an application or inserting a thumb drive away from complete disaster," said Golden Richard, the associate director for cybersecurity at the LSU Center for Computation & Technology. "Everyone should be worried."

The ransomware cyberattack targeted thousands of companies across the globe.

Richard said the only silver lining is the ransomware organizations scale the cost to retrieve your files based on the size of the infection and the scale of the attack. Businesses with large amounts of data could pay thousands of dollars compared to an individual who may be asked to pay a couple hundred dollars.

"I've taught a class in malware reverse engineering, which means taking apart viruses, worms, and ransomware to figure out how they work," Richard said.

He said his classes are becoming more and more popular. Students are signing up to become research assistants even before the positions have been funded. He says the industry and the intelligence community needs more people trained in cybersecurity.

But how can you protect yourself?

- Don't click on strange links or attachments in emails.
- Don't open emails or attachments from senders you don't recognize.
- Analyze the email messages you receive.

"Emails that mimic a real organization email are really hard to differentiate now, but usually there are some mistakes, like grammatical errors in a message from a bank or something. That's probably a good sign that it's not real," Richard said. "Many organizations won't use email as the mechanism for getting credentials from you."

Credit: Camilla Morrison, LSU

Credit: BreeAnne Crowdus

Credit: Camilla Morrison, LSU

Costume designer and LSU visiting faculty member Camilla Morrison designed wardrobe for performances from top left to right: “Mud” at the Hangar Theatre; “Ten Mile Lake” at Serenbe Playhouse; and “Passage to You” at the LSU Dance Concert.

METHODS TO THE MADNESS

The Creative Process

By Abby Jennings

Sometimes it can be scary. Sitting down at a desk or an easel, or even at a table at a local coffee shop. A page staring blankly back, waiting to be filled. For some people, being creative and creating comes as naturally as breathing. They never seem to be fazed. The pen never stops its scribbling, the paint continuously splashes across the canvas, and the melodies fill the air. At least, that’s how it may appear. However, it takes more than pure talent to create.

SETTING THE STAGE

The artistry of theater has dazzled the masses since the time of the Ancient Greeks. The power of the playwright's words, the passion of the actor, the mechanics of the stage and costumery all serve to sweep the audience away to another world. Beautiful costuming is where people like LSU Visiting Assistant Professor in Costume Design Camilla Morrison in the College of Music & Dramatic Arts come into play. The clothes worn by every actor on the stage are meticulously thought out and designed by costume designers like Morrison. The costumes must take on a life of their own and help establish characters in the world they inhabit. While this may seem like a daunting undertaking, Morrison approaches her work with tenacity and passion. Her creative process always begins with an emotional link to whatever it is that she's trying to create.

"I always think it's incredibly important to find some sort of an emotional connection," Morrison said. "I look for visual connections that will help kick off what that design or what that world that you're creating is going to be. Read the script, be inspired by the story, and find visual connections with art." When Morrison sits down to work, she begins by reading the script and source material again and again, familiarizing herself with the world of the play and the characters in it. She coordinates with the directors and actors in order to match her artistic vision with theirs. Once she understands the character, she begins to put together images that she feels connect to the work. Often searching Google and Pinterest, Morrison uses the images she finds to create a collage as inspiration for the costumes. She will then sit down at her large desk at home, a soundtrack playing in the background, and begins sketching.

> "Read the script, be inspired by the story, and find visual connections with art."
>
> —Camilla Morrison
> LSU Visiting Assistant Professor in Costume Design

Morrison says that her artistic ability thrives when she has no distractions. While the image of the struggling artist working tirelessly at a local coffee shop is prevalent in today's media, Morrison has her own recommendations for setting the scene for creative work. The coffee shop scene has never worked for her. Instead, she often isolates herself, playing movie or television soundtracks that have the same undercurrent of emotion she's hoping to create in her costumes, a row of Ticonderoga pencils meticulously and ritualistically sharpened and ready to bring her ideas to life.

"If you literally put your pencils on your desk, you're more likely to get started because it's already there. Setting less obstacles for yourself to do your creative work, setting the stage, getting your space ready, figuring out what you actually need is important," she said.

Setting up of the creative space is part of the first step Morrison teaches in her creative method workshop called "Creative Courage." Morrison has found that the first part in her own creative process, and a useful step for any young artist to get started, is to understand what environment and materials they need to be creative. Some people strive in the hustle and bustle of a coffee shop. Others need complete silence in order to focus.

"It's an individual process," Morrison said. "That's a really important thing to note, the creative process is a really individual process. If there was one thing that worked for everybody, then we would all be highly creative all the time."

Once the first step is accomplished, the next step is to figure out whether or not the possible lack of creativity is due to an internal block. Oftentimes that blank canvas or page can seem to be a creative road block, the task ahead too intimidating to even begin. Morrison's second step in her workshop is to tackle those fears and move forward.

Morrison poses these questions to artists: "If you do have the fear-based reasons of why you're not moving forward, what are those reasons? Are they simply, 'Well, I'm not good enough to tell my story, nobody wants to hear it, it's already been done, what is original that I'm doing?' There are so many fears that we all have. Naming those fears, that's a big part of it, and then basically coming up with a plan of how to squash the fear when it comes up."

She recommends free-writing and brain-dump exercises in order to generate ideas and creativity. Once the ideas are out there, she believes it will become easier to choose one of them and go forth and do the work confidently. The key is finding the connection between the artist and the creative work they're doing.

"Follow your interests and follow your passions," she advises young artists. "Your perspective is important. We want to hear your voice and we want to hear what you have to say, even if you feel like people aren't going to care. We do."

ALL WORK, SOME PLAY

Being creative also takes time. Leonardo DaVinci took approximately four years to paint his "Mona Lisa." Beethoven took four years to compose his iconic "Fifth Symphony." Creating beautiful things out of nothing takes more than talent and passion. It takes work. Ed Smith, a painting and drawing professor at LSU in the College of Art & Design, compares great

Credit: Ed Smith

Painter and LSU Professor Ed Smith draws inspiration from nature for his paintings from top left to right: “Fortunate One”; “Dreamer”; “Ark”; “Raft”; “Strain”; and “Land of Milk and Honey.”

artists to great athletes, who practice day in and day out to hone and master their skills. For him, art is not just a hobby or a talent, it is a job just like any other. Smith views his occupation in a very practical and direct way.

> “I think the most important thing is wanting to get what you think about the world down somehow.”
>
> —Ed Smith,
> LSU painting and drawing professor

“It’s like a factory job,” he said. “Most of it is really boring, standing there, covering this thing up with paint, then assessing it. It’s a lot of just drudgery. Nothing happens without showing up and being dedicated to what you’re doing. Just the repetitive nature of showing up and doing it over and over and over, helps you get better.”

Sometimes ideas for paintings simply occur to him early in the morning, but more often than not, he looks elsewhere for the spark of creativity. He gets most of his inspiration from nature, whether it be from looking at the beautiful works of John James Audubon, an artistic hero of his, or just walking his dogs and seeing a color or image that strikes him. From there, he does rudimentary sketches and then goes straight into the painting. Once he’s figured out what he wants to say, it only becomes a matter of saying it. He recommends the same for young artists looking to release their own creativity.

“You’re an artist,” Smith said. “Something’s gotta piss you off or excite you or something to make you wanna make this stuff. It's all about wanting to say something and finding the means to say it, whether it's music or poetry or painting. I think the most important thing is wanting to get what you think about the world down somehow.”

ALL THAT JAZZ

For LSU E. & D. White Professor of Jazz Studies in the College of Music & Dramatic Arts William Grimes, the idea of the “creative” process is a notion he rejects altogether.

“I struggle with the word ‘create’ versus the word ‘discover,’” he said. “The great lyricist Johnny Mercer said, ‘I don’t write lyrics.

I find them.' I prefer to think of the creative process in that way, like the process of discovery."

Though the creative process does not help him when he is playing his renowned improvisational pieces, he finds that a deadline and dedication give him the motivation to compose his new pieces. When Grimes sits down to compose, he often falls back on the familiar. Instead of trying to pluck ideas out of thin air, he often plays pieces of musical patterns that he's used before, writing down the bits he likes and leaving gaps to be filled in later. This process helps lead him to the discovery of the main idea of the piece, which he then uses to fill in the blank spaces. If he hits a creative block, he changes the setting of his writing. Instead of writing at night, perhaps he will switch to early morning. If he becomes particularly stuck on a piece, he will step away from it altogether and work in his woodshop until he feels inspired once more.

> "Music, as with any creative process, is for self-starters."
>
> —William Grimes
> LSU E. & D. White Professor of Jazz Studies

There's no particular way he gets inspired aside from just setting aside the time and dedicating himself to his work. Even daydreaming is part of a regimented creative schedule, the free flow of ideas structured by an approaching deadline. A "just do it" mentality, according to Grimes, is the best way to get work done in the creative world.

"Motivation comes from action, not the other way around. Music, as with any creative process, is for self-starters. I rarely, no, never get motivated to practice, compose, arrange, etc. I have to make myself get started. Ten minutes later the motivation comes. Once I feel that motivation, I can let ideas start to roll, accepting all of them initially, then later discarding things that don't fit," he said.

He also emphasizes the need for individuality.

"I embrace the idea that as an individual, I have the ability, actually the responsibility, to put my own personal stamp on the things I play or compose," he said. "It's sort of the opposite of conformity. I find this sense of freedom truly inspirational."

Grimes cautions young creatives to carry their love of their craft into their creative sessions, and to not get too wrapped up in the structure and frustration that can often come with trying to be creative.

Credit: William Grimes, LSU

Musician and LSU Professor William Grimes performs and teaches a Jazz master class.

"Try to make the creative process as much fun as possible," he said. "To quote my teacher Bill Dobbins, 'We often have problems when we take ourselves too seriously. We rarely have problems when we take our craft seriously.'"

Even in a world filled with beautiful music, dazzling costumes, and stunning paintings, there are even more blank pages and unwritten symphonies. The creative possibilities are endless. With these three different artists in three different fields, the idea of a creative process means something entirely different to each person. The only way to truly create is to be individual and be brave. ■

LSU Department of Chemistry Assistant Professor Louis Haber's lab consists of mirrors and other instruments used to control laser beams.

Credit: Cody Willhite, LSU

Laser Lab

Where Ultrafast Light and Precious Metals Meet

By Paige Jarreau

Visiting Louis Haber's lab in the LSU Department of Chemistry is like visiting a House of Mirrors. In the lab, a long table is adorned with hundreds of small metal stands holding mirrors of various shapes. Laser beams bend their way around the table, reflecting off of tiny mirrors, and sometimes passing through colored solutions in square glass containers. But it's when solutions of silver and gold nanoparticles are placed in the path of these lasers that we get light like we've never seen before.

Haber's lab is home to a pulsed ultrafast laser system. This laser system produces light that pulses on the order of less than a single picosecond, or one trillionth of a second.

Ultrafast lasers are used in a wide range of experiments to study details about how light interacts with atoms, chemicals, and materials. One such experiment, ultrafast spectroscopy, is used to understand what happens after a molecule or material absorbs light. This can help in developing new materials for solar panels, biological imaging technologies, and a wide range of other light-based technologies, including light-triggered drug delivery inside the human body.

Researchers in Haber's lab, including chemistry doctoral candidate Raju Kamal, are currently using the lab's pulsed ultrafast laser system to investigate the properties of nanomaterials – tiny materials that interact with different colors of light in special ways – for drug delivery and other applications.

"Light interacts with gold and silver nanoparticles in a very interesting way," Haber said.

These metal nanoparticles have free electrons at their surface that can resonate, or bounce up and down in synchrony, when a particular color of light hits them. When these free electrons in gold and silver nanoparticles resonate, they can create plasmons, or coherent oscillations of electrons, that lead to enhanced optical fields and large signals in ultrafast spectroscopy experiments. In other words, gold and silver nanoparticles can practically enhance light at their surfaces. This enhanced light can be a powerful tool for the light-triggered release of drugs attached to the surface of nanoparticles, including cancer-treating drugs that need to be delivered to specific locations of tumors inside the human body.

In collaboration with other researchers including Associate Professor of Biomedical Engineering at Penn State Daniel Hayes, who previously conducted research in the LSU Department of Biological Engineering, researchers in Haber's lab study light-triggered or light-activated drug delivery using gold and silver nanoparticles. A gold or silver nanoparticle is a very small particle of either silver or gold with size dimensions ranging from about 1 to 100 nanometers. A nanometer is the length of one-billionth of a meter. If you took a meter-long measuring stick and cut it into a billion equal pieces, each piece would be on the scale of the nanoparticles Haber's lab works with.

On the surface of these particles, researchers can attach drug molecules that only break away when a particular color or wavelength of laser light irradiates the surface of the particles. This process is called photocleavage.

"The idea is that drug molecules attached to nanoparticles can be injected into a certain part of the body and will then only release from the nanoparticles into the body or into specific cells upon irradiation with light," Haber said. "We have attached drug molecules to nanoparticle surfaces using linkers that cleave [or break apart] upon irradiation with ultraviolet light."

Using a pulsed ultrafast laser system, Haber and researchers working in his lab can practically watch the drug molecules breaking away from the nanoparticle surface after being hit with a beam of light. Using a surface-sensitive nonlinear spectroscopy process called second harmonic generation, researchers in Haber's lab can determine how quickly the drug molecules break away from the nanoparticle surface under different conditions.

Haber's lab has compared how quickly the photocleavage happens on silver nanoparticles, gold nanoparticles, and polystyrene or polymer nanoparticles.

"We find that the silver nanoparticles have the fastest and most efficient photocleaving kinetics, corresponding to approximately three times faster than the gold nanoparticles and approximately six times faster than the polystyrene nanoparticles," Haber said.

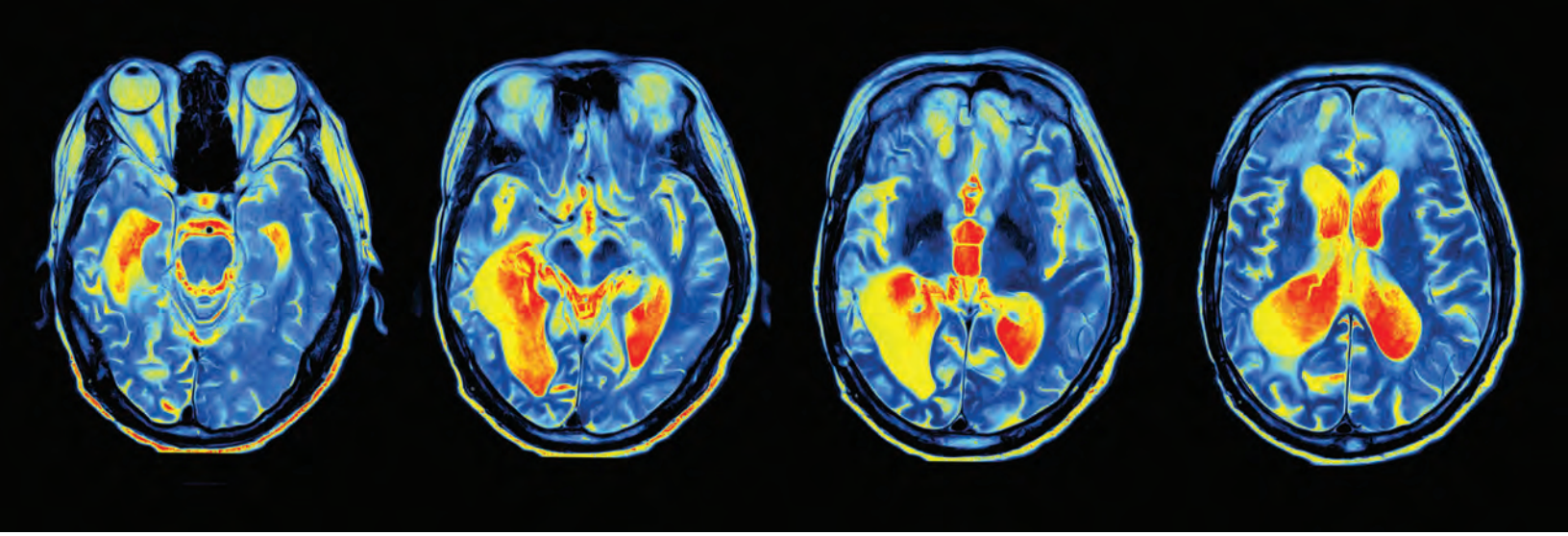
How can the drug molecules break away from the surface of the silver nanoparticles so quickly? It turns out that silver nanoparticles interact with light in a very special way, enhancing the optical field or the light hitting their surface. This "plasmon enhancement" means that the available light can do more work in breaking the light-sensitive linkers that hold the drug molecules to the silver nanoparticles. Gold nanoparticles don't enhance light at the ideal color or wavelength for this improved photocleavage, and polystyrene nanoparticles don't enhance light at all.

"It's very exciting to do this type of research that may lead to improved techniques for using nanoparticles for drug delivery," Haber said. "This work is part of a larger field of nanomedicine, where nanoparticles can be used for the treatment of different diseases for the benefit of society. It's also very interesting to do research that studies fundamental properties of nanoparticles relating to interactions with molecules and light, since the work can lead towards new discoveries that are sometimes wide-ranging or unexpected."

In the future, Haber hopes to improve how drug-carrying nanoparticles release drugs inside the human body using light as a trigger. One idea is to use a new type of layered nanoparticle made of both silver and gold to convert infrared light into heat. This heat could be used to trigger the release of drug molecules inside the human body. Infrared light is better than ultraviolet light for drug delivery applications in the body because infrared light can travel deeper into biological tissues. Haber's lab is already testing such nanoparticles with temperature-triggered linkers that hold drug molecules onto the surface of nanoparticles.

"We are getting very encouraging preliminary data on this work, so we are very excited to finish this study and publish this work soon for drug delivery applications using these near-infrared wavelengths," Haber said. ■

This article first appeared in the LSU College of Science blog, The Pursuit.



How the Brain Ages

Scientists Search for a Cure for Dementia

By Stephanie Malin

Until we hit 50, most people's brains look a lot alike—MRI scans would show similar size and comparable brain function, which means most of us are able to recall the names of people we know, cook our favorite recipes, and generally carry on our day-to-day lives.

After 50, however, the brain begins to vary among people of the same age. While some retain the same brain function for decades, others start to show significant cognitive decline in the following decades, which appears on brain scans as brain matter that has withered and died, or brain matter that is no longer functioning properly. Scans show areas of the brain, which used to be vibrant but now appear dark.

This darkness is what Institute for Dementia Research & Prevention Director Jeff Keller is fighting at LSU's Pennington Biomedical Research Center. His mission is to develop better ways to treat—and prevent—cognitive decline that steals away people's memories, lifestyles, relationships, and more.

"All other chronic diseases that we're fighting to find cures for—cancer, Crohn's disease, AIDS—they all allow you to retain your identity in that you still have the same memories, you can remember the names of your family, and you still retain the same personality. Dementia is the only disease that robs your brain of your very identity — of who you are," Keller said.

Keller oversees a number of clinical research studies aimed at preventing and treating Alzheimer's and dementia. Since it was founded in 2008, the institute has earned an Alzheimer's Disease Cooperative Study Site designation, which ranks it among some of the top institutions in the world such as Yale, Harvard, and the Mayo Clinic for Alzheimer's and dementia clinical research studies.

One such study is the Risk Reduction for Alzheimer's Disease study, or rrAD. It's a nation-wide study funded by the National Institutes of Health, and its goal is to determine whether controlling high blood pressure through medication, exercise, or a combination of both can help prevent Alzheimer's disease.

"We know that what is good for the heart is good for the brain," Keller said. "Early research is showing that exercise, proper nutrition, and adequate sleep are essential not just to our bodies but to keep our brains functioning well into our 60s, 70s, and beyond."

Keller and researchers around the country are recruiting volunteers between the ages of 60 and 85 who have a history of high blood pressure. Study participants are asked to exercise at a local YMCA regularly for two years – and potentially to also supplement with blood pressure medication – to see whether these treatments can reduce their memory loss and their future risk of developing dementia.

The rrAD study is one in a portfolio of brain aging studies at Pennington Biomedical which are looking for ways to prevent or treat Alzheimer's and dementia. There are no FDA-approved medications on the market today that cure Alzheimer's disease

or dementia, which is why studies focused on prevention are so important.

"The burden of these brain-aging diseases on our society over the next several decades is something our society isn't built to handle. As baby boomers continue to age, we're expecting the toll on our healthcare system, economy, and caretakers to be overwhelming," Keller said.

Alzheimer's and other forms of dementia are projected to cost the nation about $259 billion in 2017. By 2050 these costs could rise as high as $1.1 trillion annually, the Alzheimer's Association estimates. By that time, the number of Americans living with Alzheimer's could increase from 5 million to as many as 16 million people.

Right now, 35 percent of caregivers for people with Alzheimer's or another dementia report that their health has declined due to caretaker responsibilities. Many of these people are forced to quit jobs, miss significant amounts of work, or drain bank accounts in an effort to care for their loved one.

Mae McGuffery knows the cost of caring for a loved one with Alzheimer's.

At 68, she was living an active and vibrant life. But McGuffery's mother began to have trouble remembering things she'd always recalled easily. McGuffery grew concerned about her mother and took her to the doctor, where she was diagnosed with Alzheimer's disease. For 14 years, McGuffery and her brother took care of their mother until she passed away.

"It wasn't always easy," McGuffery said. "But love rules all. That's how we got through it."

McGuffery is now participating in the rrAD study as a way to honor her mother. She hopes that she can help others avoid the sorrow that Alzheimer's imposed upon her family.

"I have two daughters and two grandchildren. I hope my participation in this study helps them one day down the line," McGuffery said. "I am hopeful that I can help impact future generations."

Keller notes that clinical research studies — many of which are looking for participants right now — are the only way doctors are able to add to their arsenal of treatments for diseases.

"That's why research is a top priority—we can and will find ways to treat Alzheimer's and dementia, but we need the public's help. We need people to join us for these studies," Keller said. "We're making tremendous progress toward finding new medications and programs that help us prevent and treat dementia. And with the help of volunteers, we will continue to move science forward in the hopes of allowing people to live longer, healthier lives."

Like McGuffery, Biomedical Imaging Director Owen Carmichael also knows the toll that Alzheimer's disease takes on a family. Both his grandfather and father were diagnosed with Alzheimer's, which stirred his early interest in brain function. Now Carmichael is studying how the wiring of our brains affects our ability to think and how our actions and environment can affect the wiring of our brains—essentially, whether we can make a difference in our own brain health.

Much of Carmichael's work involves imaging. He uses cutting-edge technology such as functional magnetic resonance imaging, or fMRI, which can detect brain activity. The fMRI scans reveal vastly different images in people with Alzheimer's when compared to those with a healthy brain.

"A healthy brain looks kind of like a partially deflated basketball. It is round and wrinkled. If you cut that basketball down the middle, you'll see a layer of rubber in a curly shape on the outside as well as air inside. That curly rubber is like the cortical gray matter of the brain that wraps around the outside of the brain. The air inside the basketball is like the white matter of the brain, which are the communication lines that make the different parts of the cortical gray matter communicate with each other. In Alzheimer's disease, both the cortical gray matter and the white matter wither away and die leaving the 'basketball' more deflated and the 'rubber' much thinner," Carmichael said.

When Carmichael analyzes images, he looks for lesions in the white matter of the brain and how much gray matter is present.

"I look at the images and calculate how thick these regions of the brain are. When you look at the brain of someone with Alzheimer's disease, that ribbon—in some parts—is so thin that you can't even see it anymore," Carmichael said.

Carmichael has stumbled across a mystery in his work. In some people, scans show missing brain matter that should mean they have Alzheimer's disease yet their brains are functioning normally. They can recall things and complete tasks just like someone whose brain appeared to have all its brain matter intact.

"There's something that appears to protect their brains," Carmichael said. "Maybe we can bolster the brain so that instead of falling victim to the mental losses of Alzheimer's disease, it's able to push off the damage into the future, giving people many more years of mental health and quality of life. Maybe we can train the brain to resist Alzheimer's," said Carmichael in a TEDxLSU talk in 2015.

One theory is that people who are able to resist Alzheimer's disease are able to do so by resisting a certain amount of disruption caused by dead brain matter.

"We don't have a hard and fast answer right now about how to prevent Alzheimer's disease," Carmichael said. "But our work right now is yielding results that are taking us closer to a cure, one step at a time." ■

Researchers and students at the Social Media Analysis and Creation Lab at LSU can track multiple key phrases on Twitter simultaneously as well as the demographics of who is using them on several dashboards in the lab.

CREDIT: LSU and Twitter

Science of Social Media

By Ellen Smith

Social media is not just for updating your friends about where you went to lunch today. Researchers are using massive social networks in new studies to study a range of topics from disaster relief to impact factors of scientific papers. LSU professors from diverse disciplines are utilizing social media for their research in very different ways. However, an environmental sciences professor and a mass communications professor are conducting studies that are more similar than one would think, though their methods for conducting research vary as much as their disciplines.

Nina Lam, an LSU Department of Environmental Sciences professor, is leading an interdisciplinary study funded by the National Science Foundation where she and collaborators from the sociology department and the Center for Computation & Technology at LSU investigate geographical and social disparity in disaster resilience. They use Twitter as a data source.

They study geographical disparity by looking at the Twitter content surrounding two hurricanes in different areas — Hurricane Sandy in the Northeast and Hurricane Isaac in the South. The researchers chose these two storms because they both occurred in 2012; therefore, the technology was about the same. In their research, Lam and her team look at the two different regions; but within each region, they also look at the rural and urban areas to compare who tweets more.

When looking at Twitter data, Lam acknowledges that they cannot see everyone's perspective because not everyone is on Twitter. For example, people who tweet may have more access to the Internet, mobile devices, and computers as well as more time to tweet.

As part of their research, Lam and her team will distribute a survey to those who tweeted about the hurricanes in 2012 to collect the individual voices. The researchers will also conduct another survey of organizations that helped out during the disaster such as the American Red Cross and FEMA to find out how they see Twitter being used during disasters as well as what issues arise from social media.

After gathering all of this data, Lam will then apply a computer model to test to see if any of these variables can be used to predict disaster recovery. For example, if people's tweets in an area are pessimistic, is it indicative of a roadblock to recovery that can be fixed?

They are able to conduct this research by buying data sets from Twitter that contain every tweet that contains the words

"hurricane," "Sandy," or "Isaac." A full data set is about 12 million tweets from anywhere that contain these keywords. The researchers then will hone in on the area where FEMA declared a disaster to analyze the content. They plan to use the results of the project to develop algorithms that can be used to analyze social networks and ultimately improve disaster management.

Lance Porter, an LSU Manship School of Mass Communications professor, similarly studies how social media is used during times of crisis. Porter has studied how people responded to events that occurred in Baton Rouge during summer 2016 on Twitter. Porter observed the social media chatter around the fatal shootings of Alton Sterling and the three Louisiana police officers as well as the historic flooding that occurred in August. Porter noticed a significant difference in people's responses to these events on social media. While people from all over the U.S. were tweeting about the shootings, the floods were being tweeted mainly by people living in Louisiana. Porter is able to observe these trends on Twitter through a software program called Crimson Hexagon.

Crimson Hexagon is a social media analytics program comprised of dashboards that help researchers like Porter to monitor multiple key phrases. The program is set up in the Social Media Analysis and Creation Lab, or the SMAC Lab, at LSU. The SMAC Lab contains multiple large screens, which show different dashboards of tracked phrases on Twitter. Porter controls the screen through a keyboard sitting at one of the tables. Two of the dashboards he follows are for #BlackLivesMatter and #AllLivesMatter, which he examined in the wake of the shootings. Crimson Hexagon allows him to look at demographics, see where people are using these hashtags, and see who the most prominent people in the hashtag are. From there, he maps out the networks of people inside the hashtags to see if the two networks interact with each other. Thus far, he has observed very little interaction between these two polarized hashtags.

"We tend to talk to people who are like us. Our networks tend to be very closed," Porter said. Which is why, when it came to the floods in south Louisiana in August, the rest of the country was not participating in the conversation about the floods on Twitter. With the shootings, even though they took place in Louisiana, Porter explains that the shootings were part of a larger American story that engaged people beyond south Louisiana. What does that indicate to Porter?

"That particular phenomenon showed me that social media is not a replacement for traditional media," he said.

Porter's goals for his research include trying to figure out how to use social media for better political and civic engagement.

Impact

Stephen Midway, LSU Department of Oceanography & Coastal Sciences assistant professor, has turned the microscope back onto scientists who are frequent users of Twitter. He was curious to see how much of an impact Twitter has on the number of times a scientific research paper is cited. He and colleagues at Clemson University, Auburn University, Smith-Root Inc., and the U.S. Geological Survey delved into the data.

"There's a significant presence and a large community of Twitter users that are both talking about science as well as promoting their own papers, or papers they like, on social media," Midway said.

To study this, Midway and his colleagues sifted through 1,599 primary research articles randomly selected from 20 ecology journals published between 2012 and 2014. The variables included how many tweets were sent about an article and how many people potentially read those tweets. They found a positive connection between the number of times a research paper was tweeted and the number of times it was cited in the scientific literature.

"We did see a very clear effect, not a huge effect, but a clear effect of if you have more unique tweets about something, that paper tends to be cited more often," Midway said.

One possible explanation for this, posed by the researchers, is that many people in the scientific community follow roughly the same people and end up seeing the same content.

"It is also possible that the quality of a paper makes it more likely to be shared on Twitter and would become heavily cited regardless of social media activity," said co-author Brandon Peoples, assistant professor of fisheries ecology at Clemson University.

Given the variables the authors considered, the biggest predictor for the number of citations was how old a paper is. For example, a paper published three years ago is more likely to have been cited more often than a paper published this year. Compared to how long a paper has been out, Twitter activity had only one-fifth as strong of an impact. The authors suggest that scientists should not solely rely on social media to boost their citation rate, but they also should not discount it.

"Ultimately, there is no shortcut for doing impactful research. While tweeting may have some positive effect, don't expect low-quality research to get cited just by tweeting about it," Peoples said. ■

OAR Northwest rowers pull into Baton Rouge on their 100-day and more than 2,000-mile journey down the Mississippi River from Minnesota. These citizen scientists collected water samples along the river and have generated the most comprehensive dataset of microorganisms in this system to-date.

Credit: Cody Willhite, LSU

Citizen Science

Researchers Leverage People Power to Tackle the Big Questions

By Paige Jarreau

Citizen science is scientific research conducted in part or in whole by citizens, or amateur scientists. Citizen science often involves members of the general public collecting and analyzing data relating to the natural world within collaborative projects with academic or professional scientists. Researchers at LSU are increasingly harnessing the power of citizen science to not only expand the scope of their research, but to engage members of the public with science in ways that more successfully foster understanding and trust of science than traditional scientific methods and communication mechanisms.

From a project exploring the microbial communities of marine environments throughout the Gulf Coast region and beyond to a project seeking to uncover the source of very strange light patterns emanating from a distant star, citizen science is growing across disciplines.

Mississippi Microbes

As an individual researcher, there are only so many locations in the Gulf Coast region that Cameron Thrash, an assistant professor in the LSU Department of Biological Sciences whose research focuses on relationships between microorganisms and biogeochemical cycles, can sample. His dedicated group of graduate and undergraduate researchers expand that reach to some degree. But when Thrash happened to make the acquaintance of Jordan Hanssen, the founder of a not-for-profit adventure education organization called OAR Northwest, he was able to pursue a unique opportunity to create a microbial map of the Mississippi River, from headwaters to Gulf.

"Microorganisms occur in vast numbers in almost any system, with up to 10 million cells occurring in each milliliter of river water; conduct important chemical transformations of carbon, nitrogen, and other vital elements; and can contribute to remediation of pollutants," Thrash said. "Microorganisms also have tremendous diversity, and some types appear in greater or lesser abundances depending on their location, the time sampled, and because of many other environmental influences. To understand the role of microorganisms in a system, we can start by identifying how the presence and abundance of these different types relate to these different variables. However, these patterns have not been previously explored at a whole-river scale for the Mississippi River or any of the top 10 largest rivers in the world."

Two rowing expeditions by OAR Northwest have generated the most comprehensive dataset of microorganisms in this system to-date, Thrash said. The team first approached Thrash before their 2014 Mississippi River transect.

"OAR Northwest was going to be doing a row [of the entire Mississippi River], and they approached me wanting to contribute to a scientific effort," Thrash said. "We developed a protocol that would allow them to participate."

In August 2016, four OAR Northwest rowers and four shore crew members, including several students and recent graduates from the University of Puget Sound, embarked on a 100-day and more than 2,000-mile journey down the Mississippi River starting in Minnesota and finishing in the Gulf of Mexico four months later. As they rowed, paddlers collected water samples to help Thrash and his graduate researchers, including Mike Henson, determine how communities of microbes change as water conditions change along the Mighty Mississippi's journey.

The Thrash Lab sent the OAR Northwest team sample collection kits at regular intervals as they rowed down the river. Like a meal delivery service, the kits contained everything the rowers needed to collect and filter water samples as well as return the collected samples back in pre-labeled containers to the lab for analysis. Rowers collected samples at dozens of locations from Minnesota to the Gulf of Mexico, filtering water to capture microorganisms, and capturing chemical and physical information about the river at each site. These samples were shipped from pre-determined locations with the help of volunteers back to the Thrash Lab at LSU in temperature-monitored coolers. At the same sites, rowers had new sampling supplies waiting.

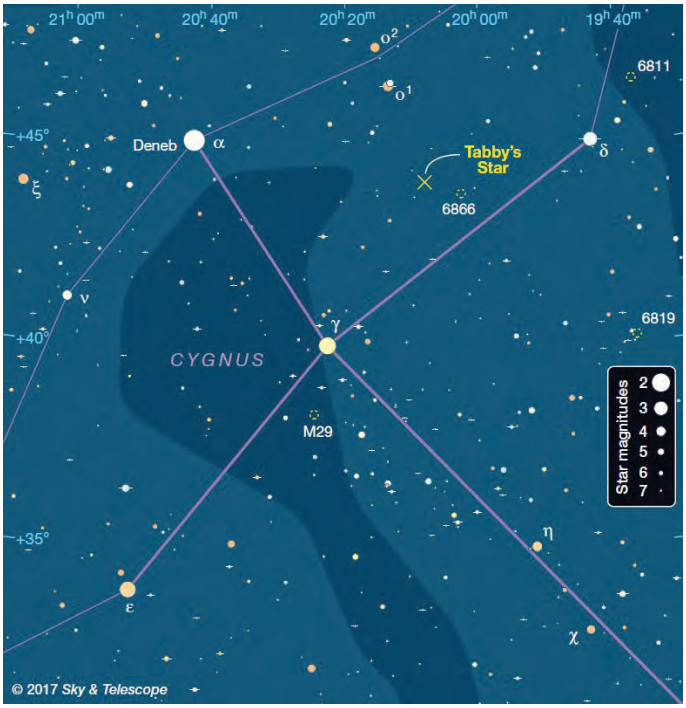
"We made the protocol as simple as possible, and we had great success," Thrash said.

"Science has never been a subject I felt that I was particularly good at," said Audra Tromly, an OAR Northwest rower and a recent communications graduate of the University of Puget Sound. "Multiple times a week, we had to lean over our boats and [while] using test tubes, mini bottles, and other various filters and syringes I don't completely understand, get up-close and personal with the river. Despite my initial fears and hesitations, I put on the gloves and picked up the test bottles. I quickly gained an important perspective on science:

> "Science is not this big, scary monster. Science is really just asking questions and then making and testing predictions in order to better understand the world around us. Everyone and anyone can do science or be a scientist, including me."
>
> —Audra Tromly
> Citizen scientist

Back in the lab at LSU, graduate student Henson processed the samples collected by the OAR Northwest rowers, extracted DNA, and conducted cell counts. A research group at the University of Washington performed chemical measurements on the same water samples.

"The extracted DNA provided sequence information for a gene common to all organisms," Thrash said. "This acts like a barcode so we can determine the specific organisms in a given



Credit: Sky & Telescope

Tabetha Boyajian, an assistant professor in the LSU Department of Physics & Astronomy, has a star in her name. But it was a group of citizen scientists, via Zooniverse's Planet Hunters, a web-based citizen science project, who first discovered strange light patterns emanating from KIC 8462852, or "Tabby's Star."

sample. We then analyzed all the different variables together to generate a picture of how the microbial communities changed from site to site along the river."

Based on data from the 2014 row, Thrash's lab group found a major change in microbial communities at the confluence of the Missouri River corresponding to a dramatic increase in river volume. In general, they found the Mississippi River water became cloudier and had more nutrients related to the depletion of oxygen from the water above the Missouri River whereas below, the microbiome was more stable.

"I learned a lot from this experience [and] about citizen science," Thrash said. "Having gone through it, I'm thinking about ways that citizen science could become more commonplace in my research projects."

OAR Northwest will be involved in the publication process as well as various other aspects of the project as well.

The Most Mysterious Star in the Universe

Tabetha Boyajian, an assistant professor in the LSU Department of Physics & Astronomy, has a star in her name.

Credit: LSU

Tabetha Boyajian

But it was a group of citizen scientists, via Zooniverse's Planet Hunters, a web-based citizen science project, who first discovered strange light patterns emanating from KIC 8462852, or "Tabby's Star."

The Planet Hunters site trains citizen scientists, including people from all walks of life and levels of astronomy knowledge, to read star light curves captured by NASA's Kepler space observatory. Through the project, anyone can help find undiscovered planets by looking at how the brightness of a star changes over time, because dips in brightness over time can be explained by planets transiting or passing in front of the star as seen from Earth. By monitoring the light curves of KIC 8462852, Planet Hunters' volunteers found that the star regularly undergoes a series of odd, sharp dips in brightness. But these dips are so strange, so irregular, that they can't be explained by a planet transiting the star or any other usual behavior. For this reason, Tabby's Star has been called the most mysterious star in the universe.

"The human brain has an amazing ability for pattern recognition, sometimes even better than a computer," Boyajian said during a TED talk in 2016.

> "I learned a lot from this experience [and] about citizen science...Having gone through it, I'm thinking about ways that citizen science could become more commonplace in my research projects."
>
> —Cameron Thrash
> LSU Department of Biological Sciences assistant professor

Planet Hunters harnesses that ability and enables citizens, scientists, and amateurs alike, to contribute to scientific research. The science team behind Planet Hunters has published several papers on planets found through the project that computers have missed.

Boyajian joined the Planet Hunters team in 2012 as a postdoctoral fellow in the exoplanets group at Yale. Soon afterwards, she was notified by Planet Hunters users of a very unusual star.

"When Planet Hunters users were classifying the Kepler data, they came across this one star that didn't fit into any category that they had seen before," Boyajian said. "They started talking about it and talking about it. It took a while for this discussion to reach the Planet Hunters science team. When I first learned about it, I wouldn't have given it a second thought if it weren't for some of the experienced Planet Hunters users I know personally convincing me to look at the data more closely. At first, I just thought the data was bad. If it weren't for citizen scientists, this is something we would have missed."

One of the most powerful things about citizen science projects, Boyajian said, is that citizens can identify trends or discover things that are really cool that scientists wouldn't have been looking for.

"This was a serendipitous discovery that happened because a group of people was sifting through the dataset. It likely wouldn't have been found otherwise," she said.

Boyajian published a paper about the star in 2016, and as a researcher at LSU continues to study this particular star, among others, in collaboration with various citizen science groups and amateur observers. In her 2016 paper coauthored by researchers at various institutions and even amateur astronomers, Boyajian concluded that the most likely explanation for the light dips in data from the star was the passage of a family of exocomets, planetesimal fragments or debris left over from comet collisions.

One of the strangest and most unlikely explanations that others have suggested is that an alien megastructure surrounds the star. Brad Schaefer, a professor in the LSU Department of Physics & Astronomy, has also published data about Tabby's Star revealing that the star has been experiencing a strange long-term dimming over time.

To really figure out what's going on with this star, Boyajian and collaborators need more data.

"We need more information on the color of these dips in light," Boyajian said. "Kepler only observed this star in one wavelength – it didn't give any color information. Color information could tell us the composition of the material passing in front of this star. If it's a cloud of dust, the data signal will have a different shape and depth in the blue range [more] than it does in red. If it's an opaque object such as a planet, the signal will look different still. Color information will tell us a lot."

Since the original discovery of the star, Boyajian has been working with astronomers and amateur observers through the American Association of Variable Star Observers, or AAVSO, to get more data from individual observations of KIC 8462852, which can be clearly seen using a small telescope. Following an AAVSO alert about this star in October 2015, more than 50 observers around the world have been contributing data to the AAVSO database that Boyajian can use. The observers come from all walks of life, from a former engineer at NASA's Jet Propulsion Lab to an owner of a bike shop in Arizona.

> "If it weren't for citizen scientists, this is something we would have missed."
>
> —Tabetha Boyajian
> LSU Department of Physics & Astronomy assistant professor

"I'm working with people who just want to contribute to science. It's amazing," Boyajian said. "It's also a brilliant solution, because with 50 people observing all over the world... if it's raining at one site, it's clear in another; or, if it's daytime at one site, it's nighttime in another. We actually get full coverage in terms of monitoring of the star."

Citizen science does come with its challenges. The quality of the data collected from amateur observers depends largely on the experience of each observer, and individual observations aren't ideal for capturing star signals in real-time. Cleaning and synthesizing the KIC 8462852 data collected by amateur observers isn't trivial. Boyajian has worked with AAVSO to develop detailed instructions for observers to help them collect better data from the star using proper scientific standards and calibrations.

In May 2016, Boyajian also started a crowd-funding Kickstarter campaign titled Where's the Flux that raised more than $100,000 to secure more than a year's worth of professional robotic telescope time to solve the mystery of KIC 8462852. Many of the backers and amateur observers of KIC 8462852 are extremely engaged and are contributing to scientific research a few dollars at a time. Boyajian and several other volunteers created a Reddit page just for questions and discussion around the star and new data from it. The page now has more than 6,000 active users. New data is posted to a blog daily at www.wherestheflux.com/blog.

"It's been great to have that feedback, to see people getting really excited about the science," Boyajian said.

Only time will tell what exactly is passing in front of the most mysterious star in the universe. In the meantime, citizen scientists have helped Boyajian and her colleagues detect several dips in light in real-time and have had the opportunity to even name them. ■

Credit: Tobias Baldauf

LSU Department of Physics & Astronomy Professor Gabriela González and Stephen Hawking at Lady Mitchell Hall, Cambridge University.

A Big Year

By Alison Lee Satake

From being named one of the 10 people who mattered by the scientific journal Nature to being elected into the National Academy of Sciences and receiving a personal invitation from Stephen Hawking to present at his 75th birthday symposium, LSU Department of Physics & Astronomy Professor Gabriela González has had quite a year.

González is an experimental physicist with the Laser Interferometer Gravitational-wave Observatory, or LIGO, who contributed to the detection of gravitational waves in 2015 predicted by Albert Einstein's Theory of General Relativity. Her research and work as the former spokesperson for the 1,000-member international LIGO Scientific Collaboration opened a new window of discovery to the cosmos. This milestone discovery was recognized as the 2016 Breakthrough of the Year by Science magazine.

Her current research involves the reduction and characterization of noise to enhance the laser interferometers' sensitivity to detect gravitational waves, calibrate the

Credit: National Academy of Sciences

Left to right: David H. Reitze, executive director, LIGO Laboratory at California Institute of Technology and a professor of physics at the University of Florida, Gabriela González, professor of physics and astronomy at LSU and Paul Saulson, Martin A. Pomerantz '37 professor of physics at Syracuse University.

Credit: LSU

detectors, and analyze data. She has been recognized as one of the "Ten People Who Mattered" by the scientific journal Nature; a recipient of the 2017 National Academy of Sciences Award for Scientific Discovery; a newly elected member of the National Academy of Sciences and the American Academy of Arts and Sciences; and Scientist of the Year by Great Minds in STEM. She also received the 2017 Bruno Rossi prize from the American Astronomical Society; the 2016 Jesse Beams award from the American Physical Society; and the Doctorate Honoris Causa from her alma mater, the National University of Cordoba, Argentina. González joined the faculty at LSU in 2001.

On July 2, González was one of four high-profile speakers invited to share the stage with Stephen Hawking for his 75th birthday public symposium at Cambridge University. The other speakers included Brian Cox, Martin Reese, and Stephen Hawking.

Hawking also invited González to present at an international scientific conference titled, "Gravity and Black Holes" to discuss recent advances in gravitational physics and cosmology, and the exciting future of this field following the direct detection of gravitational waves. Scientists from Harvard, Cambridge University, Stanford University, U.C. Berkeley, and other top universities presented their research as well. ■

Credit: National Academy of Sciences

The National Academy of Sciences recognized three LIGO scientists with the 2017 NAS Award for Scientific Discovery on April 30 including Gabriela González, professor of physics and astronomy at LSU.

Gabriela González was one of the 84 newly elected National Academy of Sciences members recognized for her distinguished and continuing achievements in original research.

Credit: Cody Willhite, LSU

At the LSU Rainmakers event were, left to right: Provost Rick Koubek, Campus Federal Credit Union President and CEO Dawn Harris, Associate Vice President for Research & Economic Development Stephen David Beck, Associate Professor Donghui Zhang, Associate Vice President for Research & Economic Development Gus Kousoulas, the Mary P. Poindexter Professor of Mass Communication Lance Porter, Assistant Professor Rendy Kartika, Vice President of Research & Economic Development Kalliat T. Valsaraj, Professor Kermit Murray, the Louise & Kenneth Kinney Professor of Black Drama and Playwriting Femi Euba, and Assistant Professor Benjamin Kahan.

RAINMAKERS

As a top-tier research institution, LSU's research faculty are proven leaders in their field, performing at truly outstanding levels each day. LSU's Office of Research & Economic Development, with the support of Campus Federal Credit Union, takes the opportunity each year to acknowledge some of our many outstanding faculty with the Rainmaker Awards for Research and Creative Activity.

Faculty members chosen as Rainmakers are those who balance their responsibilities in the classroom with securing external funding for their research and broadly disseminating their findings to not only the scholarly community but to society as a whole. Exemplary representatives of LSU, who garner both national and international recognition for their innovative research and creative scholarship, while also competing for external funding at the highest levels and attracting and mentoring exceptional graduate students.

Each of the following award-winning faculty members has met one or more of the criteria for high-quality research or creative activities and scholarship, which include but are not limited to publication in a high-impact journal(s); highly cited work; external awards; invited presentations at national and international meetings; high journal publication productivity; critically acclaimed book publication(s), performance(s), exhibit(s), or theatrical production(s); high grant productivity; and, for more senior candidates, outstanding citation records and high-impact invited presentations at national and international meetings. Two awards are granted at each career level including the Emerging Scholar, Mid-Career Scholar, and Senior Scholar levels.

All Rainmaker recipients receive a one-time stipend of $1,000 and a plaque in recognition of their achievements.

Emerging Scholar Award

Arts, Humanities, Social & Behavioral Sciences

Benjamin Kahan is an assistant professor of English and Women's and Gender Studies. Along with interests in 20th century American literature and culture, Kahan's scholarship focuses on the history of sexuality and gender, queer theory, psychoanalysis and sexology, race and ethnicity, and critical theory.

He is the author of "Celibacies: American Modernism and Sexual Life" and the editor of Heinrich Kaan's "Psychopathia Sexualis (1844): A Classic Text in the History of Sexuality."

He has held postdoctoral fellowships at Washington University in St. Louis, Emory University; the University of Pittsburgh; and the University of Sydney. He is currently a Fellow at the National Humanities Center for 2016 and 2017.

Credit: Eddy Perez, LSU

Emerging Scholar Award

Science, Technology, Engineering & Mathematics

Rendy Kartika is an assistant professor in the Department of Chemistry. After conducting postdoctoral research at Yale University, Kartika joined the LSU faculty where his research program focuses on the discovery of new organic reactions that produce biologically and pharmaceutically relevant molecular scaffolds. At LSU, Kartika has independently published 12 peer-reviewed articles in various high impact journals and delivered more than 40 invited lectures, including the prestigious Gordon Research Conference in Natural Products and Bioactive Compounds. In 2015, Kartika successfully secured a highly competitive chemical synthesis grant from the National Science Foundation as a single PI.

In recognition of his teaching contribution at LSU, Kartika received the Tiger Athletic Foundation Undergraduate Teaching Award in 2015. He was also named the Outstanding Non-Tenured Professor in Natural and Physical Sciences by LSU Phi Kappa Phi in 2017.

He emigrated from Malang, Indonesia to the U.S. to attend California State Polytechnic University, Pomona and received his B.S. degree in chemistry with summa cum laude in 2003. As an undergraduate researcher, he explored the synthetic utility of super electrophilic species. In 2008, Kartika earned his Ph.D. degree in organic synthesis from the University of Notre Dame and developed applications of the electrophile-induced ether transfer reactions in the synthesis of anti-cancer natural products.

Mid-Career Scholar Award

Arts, Humanities, Social & Behavioral Sciences

Lance Porter directs the Social Media Analysis and Creation, or SMAC, Lab in the Manship School of Mass Communication, where he holds the Mary P. Poindexter Professorship. Porter's current research focuses on the cultural effects of social media. Some of his students work with the nonprofit organization Dialogue on Race in Louisiana to encourage productive conversations about race on social media. His work has appeared in numerous journals and books devoted to advertising, journalism, public relations, health communications, and sport.

Before coming to LSU in 2004, Porter spent four years as executive director of digital marketing for Disney, where he oversaw the creative and digital media strategies for more than 80 films. Porter won a Clio Award for excellence in advertising.

After earning his Ph.D. from the University of Georgia, Porter continued his interdisciplinary work at LSU through a joint appointment with the Center for Computation & Technology, where he helped develop an undergraduate minor and master's degree in digital media.

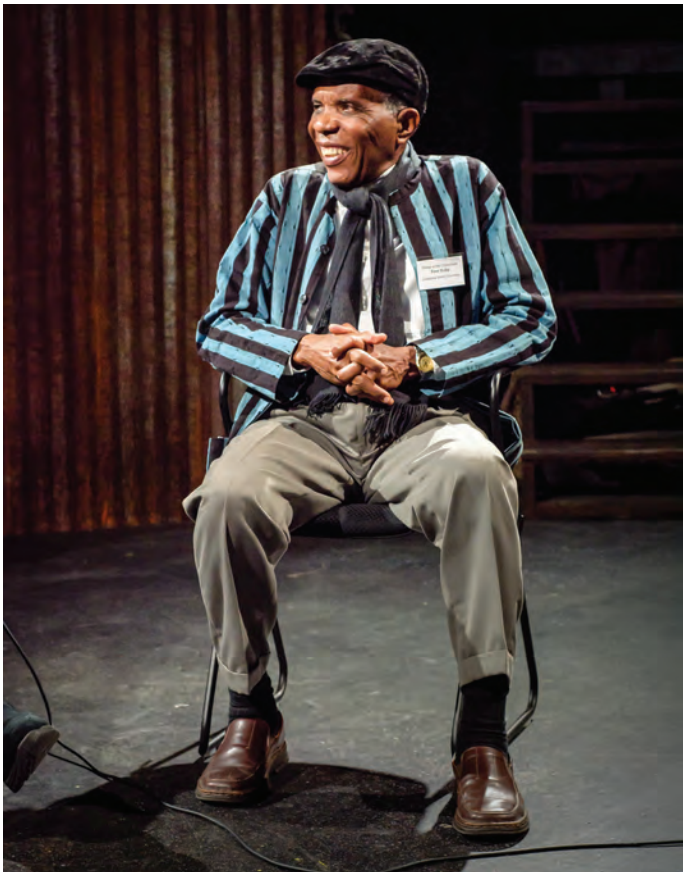
Mid-Career Scholar Award

Science, Technology, Engineering & Mathematics

Donghui Zhang is an associate professor in the Department of Chemistry. Her research interests include polymer catalysis, synthesis, and characterization of biomimetic, bioinspired, and bio-relevant functional polymers, high precision macromolecules. She joined the LSU faculty in 2007.

She received the Phi Kappa Phi Non-tenured Faculty Award in 2013, the LSU College of Basic Sciences Faculty Research Award in 2012, a National Science Foundation CAREER Award in 2010, and the Ralph E. Powe Junior Faculty Enhancement Award in 2009.

After graduating from Peking University in 1998 and receiving a Ph.D. in organometallic chemistry from Dartmouth College in 2003, Zhang's postdoctoral research focused on the synthesis and characterization of polymers from bio-renewable source materials at the University of Minnesota. She previously served as a faculty researcher at New Mexico State University.



Credit: LSU College of Music & Dramatic Arts

Senior Scholar Award

Arts, Humanities, Social & Behavioral Sciences

Femi Euba is the Louise & Kenneth Kinney Professor of Black Drama and Playwriting in the School of Theatre. He has acted and directed professionally in Nigeria, London, and the U.S. along with having written numerous plays for BBC Radio. A selection of his plays is published in a database collection, "BLACK DRAMA" by Alexander Street Press including "The Eye of Gabriel," which had its premiere production at the LSU Theatre in 1998.

Euba received a master's degree in Afro-American Studies and a Master of Fine Arts in playwriting and dramatic literature from Yale University. He also earned a Ph.D. in literature at the University of Ife, Nigeria. He holds a joint appointment in the Departments of Theatre and English.

A recipient of the LSU Alumni Association Faculty Excellence Award and the LSU Distinguished Faculty Award, he has worked with the 1986 Nobel Laureate for Literature Wole Soyinka on various works including Soyinka's presentation of his long poem, Samarkand, in 2005 at the Shaw Center for the Arts in Baton Rouge.

Senior Scholar Award

Science, Technology, Engineering & Mathematics

Kermit Murray is a professor in the Department of Chemistry. His current research focuses on instrument development and applications of laser desorption ionization mass spectrometry. He developed a novel spray ionization method for matrix-assisted laser desorption/ionization, or MALDI, mass spectrometry. Before coming to LSU in 1991, Murray's postdoctoral research focused on infrared spectroscopy.

He earned his bachelor's degree in chemistry at the University of California, Berkeley, in 1982. He received a Ph.D. in chemical physics at the University of Colorado in 1988, working with Professor W. Carl Lineberger on the chemistry and spectroscopy of negative ions.

Presidential Award for Discovery

LSU Department of Physics & Astronomy Professor **Gabriela González** received the first Presidential Award for Discovery from the Office of Research & Economic Development, or ORED. She is an experimental physicist with the Laser Interferometer Gravitational-wave Observatory, or LIGO, who contributed to the detection of gravitational waves in 2015 predicted by Albert Einstein's Theory of General Relativity. Her research and work as the former spokesperson for the 1,000-member international LIGO Scientific Collaboration opened a new window of discovery to the cosmos.

The Presidential Award for Discovery is given by ORED to individual faculty in recognition of outstanding singular achievements in research, scholarship, or creative activity that have received the highest professional recognition from their peers. ■

ACCOLADES

Two LSU Professors Named as National Academy of Inventors Fellows

Isiah Warner

Credit: LSU

Mandi Lopez

LSU Boyd Professor of Chemistry and SEC Professor of the Year Isiah Warner and Professor of Veterinary Surgery Mandi Lopez have been named Fellows to the National Academy of Inventors, or NAI. Warner and Lopez are two of the 757 NAI Fellows representing 229 research universities, governmental agencies, and non-profit organizations.

Warner is the Phillip W. West Professor of Chemistry and Howard Hughes Medical Institute Professor at LSU. His research aims to develop and apply chemical, instrumental, and mathematical measurements to solve fundamental questions in chemistry. The Bunkie, La., native also serves as LSU's Vice President for Strategic Initiatives, and he is one of the world's experts in analytical applications of fluorescence spectroscopy.

Warner holds eight U.S. patents that specialize in spectroscopy and span a variety of research areas. His spectroscopy studies have become mainstays for many leading manufacturers of commercially available fluorescence in analytical measurements.

"I am truly excited about all of the recognition I have received for the year 2016. This is one of the most exciting years of my entire career," Warner said. "In science, there is no greater honor than to be recognized by your peers."

As a veterinarian surgeon, Lopez created a device for ACL reconstruction surgery that makes it easier to secure tissue to bone, while tension is simultaneously adjusted – a feat which could not previously be accomplished. The device could potentially be used in future bone and joint surgeries in both animals and humans.

> "This is one of the most exciting years of my entire career...In science, there is no greater honor than to be recognized by your peers."
>
> —Isiah Warner
> LSU Boyd Professor of Chemistry

Lopez is the director of the Laboratory for Equine and Comparative Orthopedic Research in the LSU School of Veterinary Medicine. As laboratory director, Lopez has mentored numerous undergraduate, graduate, and medical students. She has more than 75 original scientific publications and has shared research findings through hundreds of presentations in numerous public venues. She is an associate editor of a national scientific journal, as well as a member of many public and private grant review boards. She has been an active member of the LSU faculty senate for nearly a decade and also serves on the faculty senate executive committee.

"The honor is beyond any accomplishment that I thought to achieve during my career. I'm incredibly humbled and genuinely grateful," Lopez said. "Such an achievement would not have been possible without the support and confidence of others who believed in me and my inventions."

Warner and Lopez were nominated by their peers for contributions in areas such as patents and licensing, innovative discovery, and technology, and support and enhancement of innovation. Being elected as an NAI Fellow is a high professional distinction accorded to academic inventors who have demonstrated a prolific spirit of innovation in creating or facilitating outstanding inventions that have made a tangible improvement on quality of life, economic development, and the welfare of society.

Credit: Marsha Cuddeback

MoMA's Frank Lloyd Wright Exhibition Guest Curated by LSU Professor

Credit: LSU

LSU School of Architecture Professor Michael Desmond was a guest curator for an exhibition on Frank Lloyd Wright at the Museum of Modern Art in New York. The exhibition, Frank Lloyd Wright at 150: Unpacking the Archive, comprised "approximately 450 works made from the 1890s through the 1950s, including architectural drawings, models, building fragments, films, television broadcasts, print media, furniture, tableware, textiles, paintings, photographs, and scrapbooks, along with a number of works that have rarely or never been publicly exhibited."

A lifelong Frank Lloyd Wright scholar, Desmond wrote his MIT Ph.D. dissertation on Wright's partially built subdivisions and community designs from 1936–47. At the time, Desmond's dissertation, A Clearing in the Woods: Self & City in Frank Lloyd Wright's Organic Communities, was the first on Wright to come from an Ivy League university in almost 30 years.

Desmond, who frequently lectures on Frank Lloyd Wright, is currently expanding that dissertation into a book focused on Wright's increasing use of circles and circular arcs over the last 20 years of his career as means of engaging architectural form and perception of landscapes.

Structured as an anthology, the exhibition was divided into 12 sections curated by Wright scholars, historians, architects, and designers. As well as determining themes and selecting objects to represent these, the guest curators contributed articles on their sections for the exhibition catalog and book. Desmond discusses his section of the exhibition and book chapter, titled "Abstracting the Landscape: Galesburg Above and Below the Surface," in a short film that accompanied the exhibition.

"Out of Wright's 1,200 designs, some 450 were built, leaving over 700 unbuilt, many of which were spectacular houses and communities designed to integrate with the landscape of their specific sites in ways that have not been studied," Desmond said.

His initial research for the book included combing through the 30,000 drawings in the Frank Lloyd Wright Foundation, formerly housed outside Phoenix, Ariz.

Three years ago, the Frank Lloyd Wright Foundation donated the drawings to Columbia University's Avery Library Archive and the models to the Museum of Modern Art.

"It was a watershed moment, making the archive much more accessible," said Desmond, who was the first person to visit the Avery collection once it was opened.

LSU Professor Awarded National Endowment for the Humanities Fellowship

Credit: LSU

LSU Department of English Associate Professor Katherine Henninger has been awarded a National Endowment for the Humanities fellowship. A variety of humanities-based research and programs will be supported by $16.3 million in grants.

The fellowship will support the research and writing of Henninger's third book titled, "Made Strangely Beautiful: Southern Childhoods in U.S. Literature and Film." She is one of 86 university faculty in the country to receive the recent round of NEH fellowships to support advanced research.

"I'm thrilled and honored for my work to receive the national recognition and support that the NEH Fellowship confers," Henninger said.

"This prestigious fellowship adds to the large body of work on southern culture and further solidifies LSU as a leader in this area of research. I am pleased that Dr. Henninger's innovative work will continue to advance humanities research even further," said Dean Stacia Haynie, LSU College of Humanities & Social Sciences.

While designing an undergraduate course about the South in literature and film at LSU several years ago, Henninger saw that representations of childhood were a recurring theme in such classics as "The Adventures of Huckleberry Finn," "To Kill a Mockingbird," and "Beasts of the Southern Wild."

"However, I was amazed to find that there exists almost no broader scholarship on the long, curious but utterly canonical tradition of narrativizing southern childhood in U.S literature and film. My book is an attempt to fill that gap, making connections between past and contemporary representations," she said.

Her book, "Made Strangely Beautiful," is an interdisciplinary rhetorical analysis of tropes of childhood in literature and film of or about the South, focusing particularly on contemporary representations. Southern children are depicted as figures of both natural innocence and social corruption as well as essential purity and fundamental ambiguity. These figurative children embody the fissures of race, sexuality, gender expression, and class that threaten to undermine liberal rhetoric of U.S. national identity, and also represent the nation's best hope of transcending those divisions.

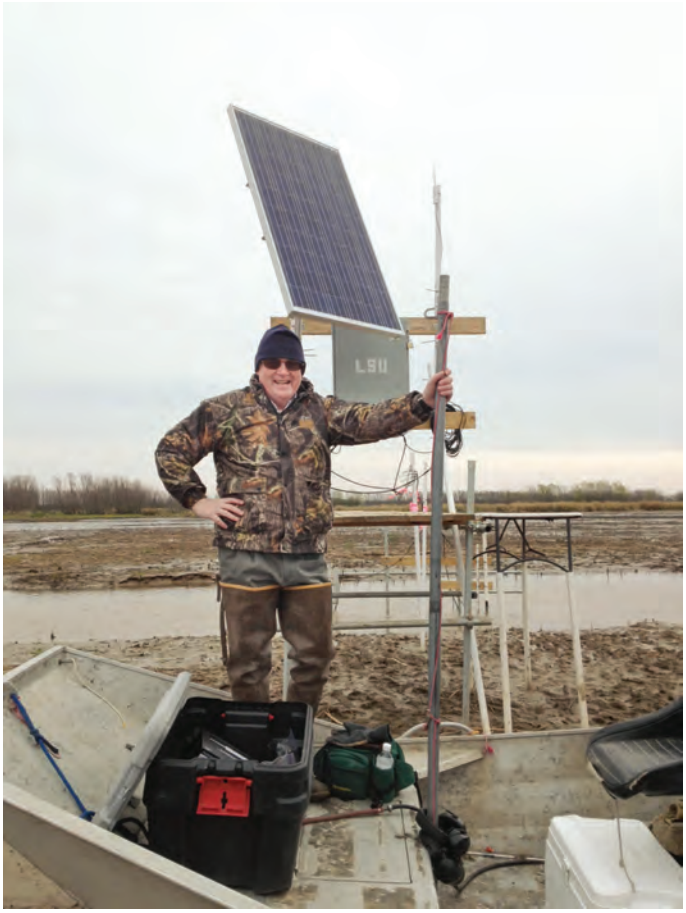
Credit: Universal International Pictures

"This prestigious fellowship adds to the large body of work on southern culture and further solidifies LSU as a leader in this area of research."

—Stacia Haynie
LSU College of Humanities & Social Sciences dean

"Through a series of textual case studies, I demonstrate that even, and perhaps especially, in a nation grasping toward a post-millennial, post-racial, post-southern future, the ever-vital, endangered, often ugly, strangely beautiful southern child is made to lead the way," she said.

Louisiana Sea Grant Executive Director Receives National Wetlands Award



Credit: Louisiana Sea Grant College Program

Louisiana Sea Grant Executive Director Robert Twilley is the recipient of the 2017 National Wetlands Award for Science Research from the Environmental Law Institute, or ELI. He received his award in a ceremony at the U.S. Botanic Gardens in Washington, D.C.

"[Robert] is a world-class wetlands researcher who has been conducting vital research for 35-plus years focused on some of the most impressive global wetland ecosystems," said John White, a professor in the LSU College of the Coast & Environment, who nominated Twilley for the award. "He has conducted research on submerged aquatic vegetation beds in the Chesapeake Bay, on mangrove forests in the southwest Florida Everglades, and had participated in both scientific and management positions related to the massive coastal wetland losses of the Mississippi River Delta."

Over his career, Twilley has produced 150 peer reviewed publications, which generated hundreds of citations. Of note, his work includes the first global carbon budget and a blue carbon value of mangroves. As a defender of wetlands and a leader in wetland science, he has pioneered a variety of research partnerships, collaborations, and outreach projects. He has also testified in several U.S. House and Senate subcommittee hearings and delivered briefings to a variety of other departments in the U.S. government.

"Not only does he do cutting-edge new research, but he also puts equivalent effort into extending that research, in communicating the results to communities and groups that need answers to their questions, and to applying those results to the preservation and restoration of critical wetland habitats of the Americas," wrote Charles Hopkinson, professor in the Franklin College of Arts and Sciences at the University of Georgia in his nomination support letter.

Twilley is a professor in the LSU Department of Oceanography & Coastal Sciences in the College of the Coast & Environment, and was named Louisiana Sea Grant College Program executive director in 2012.

> "[Robert Twilley] is a world-class wetlands researcher who has been conducting vital research for 35-plus years focused on some of the most impressive global wetland ecosystems."
>
> —John White
> LSU College of the Coast & Environment professor

"Robert is passionate about extending locally important research to the myriad of stakeholder groups in coastal Louisiana. I think he's taken an already good Sea Grant program to the next level of excellence," Hopkinson said.

Now in its 28th year, the National Wetlands Awards has recognized more than 200 individuals from across the country for their exceptional and innovative contributions to wetland conservation.

Fulbright Awards LSU Art & Design Professor to Conduct Research in China

LSU College of Art & Design Associate Professor of Design Richard Doubleday has been named a Fulbright senior scholar. The Fulbright Scholar Program supports his research on contemporary Chinese graphic design at Beijing's prestigious Tsinghua University, the Academy of Arts & Design, and the China Central Academy of Fine Arts.

The Fulbright Scholar Program awards scholars and students to conduct research abroad. About 1,200 U.S. scholars; 1,600 U.S. students; 4,000 foreign students; and 900 visiting scholars receive awards annually.

> "Graphic design, as we know it today, didn't really exist in China in 1979, and now there are hundreds of graphic design schools and thousands of design students."
>
> —Richard Doubleday
> LSU College of Art & Design associate professor

Doubleday first became interested in Chinese graphic design after leading seminars at Chinese universities. He has also written essays and reviews on graphic design that have been translated into Mandarin and was featured as a guest writer in a special edition of Tsinghua University's Zhuangshi Chinese Journal of Design.

Over the past 10 years, Doubleday has gone to China at least once a year to teach seminars and workshops at various Chinese design schools. He was particularly drawn to the way Chinese graphic designers combine Roman typography and traditional Chinese calligraphy to create an interesting and appealing visual aesthetic.

Doubleday is researching Chinese graphic design, particularly modern design that has flourished since the opening of the Chinese economy in 1979. He is studying the relationship between mainland Chinese graphic design and design in Hong Kong, Taiwan, and Macau. Doubleday said his interest lies in charting the dramatic change in graphic design that occurred when China adopted a free market economy.

Credit: Richard Doubleday, LSU

"It's overwhelmingly impressive to go over there and see the development and how much things have changed in such a short amount of time," Doubleday said. "Graphic design, as we know it today, didn't really exist in China in 1979, and now there are hundreds of graphic design schools and thousands of design students."

Doubleday also tries to bridge his work between China and LSU. The LSU School of Art has hosted faculty from Chinese universities at LSU to share skills and methods between the two countries. Doubleday said this exchange provides mutual benefits for both the Chinese and LSU scholars, and helps LSU build international collaborations.

National Council Awards Roy Keller the Small Business Advocacy Lifetime Achievement Award

Credit: LSU

Roy Keller, director of the Louisiana Technology Transfer Office and associate director of the Louisiana Business and Technology Center at LSU, was given a Lifetime Achievement Award by the Small Business Technology Council of the National Small Business Association for his work supporting and promoting the Small Business Innovation Research program. Keller was presented the award in the Senate Small Business Committee hearing room in Washington, D.C.

The Louisiana Technology Transfer Office, or LTTO, was established as a unit of the LSU business incubator in 1990 and has offices at LSU and at the NASA Stennis Space Center.

Keller joined the Louisiana Business & Technology Center at LSU in 1992, where he serves as manager for Louisiana Small Business Innovation Research grant program and has access to the Federal Laboratory Consortium. He provides education and outreach programs to Louisiana universities, small businesses, government officials, and small businesses interested in competing for these technology research grants.

"Mr. Keller is a leader in the national SBIR grant program. We are honored to have this national recognition for the work that he has done for the state of Louisiana. Since implementing this program, Louisiana has moved up in national rankings from 45 to a top 30 position for SBIR grants won by Louisiana small businesses," said Executive Director of the LSU Innovation Park Charles F. D'Agostino.

Roy Keller provides education and outreach programs to Louisiana universities, small businesses, government officials, and small businesses interested in competing for technology research grants.

Louisiana companies have won more than $85 million in SBIR awards through the LSU-LTTO since 1990.

LSU Coastal Sustainability Studio Garners National Spotlight

Credit: University of Pittsburgh

LSU Coastal Sustainability Studio Director and LSU School of Architecture Associate Professor in the College of Art & Design Jeff Carney presented at the White House Frontiers Conference on "Educating for Climate-Smart Design" hosted by President Obama in October 2016. The national convening explored the future of innovation in the U.S. and around the world.

"It is an honor and privilege to join such a diverse group of innovators from across the country," Carney said. "Connecting design research and design education is a central theme to our work, and I am excited to represent LSU at this event."

"Connecting design research and design education is a central theme to our work."

—Jeff Carney
LSU Coastal Sustainability Studio director

The convening included topics inspired by the November issue of WIRED, which was guest-edited by the President on the theme of "Frontiers." The conference focused on building U.S. capacity in science, technology, and innovation and the new technologies, challenges, and goals that will continue to shape the 21st century and beyond.

In July 2017, LSU Coastal Sustainability Studio also was awarded funding from the National Academies of Sciences' Gulf Research Program and the Robert Wood Johnson Foundation. Carney leads a multidisciplinary research team that seeks to improve understanding of inland-coastal environmental conditions and vulnerabilities; determine indicators of community health and wellbeing; and develop design and planning best practices for reducing risk and increasing adaptive capacity.

Credit: LSU

LSU Boyd Professor Named Bellagio Writing Residency Fellow

LSU Boyd Professor of English J. Gerald Kennedy was named a Bellagio Writing Residency Fellow after recently publishing his book, "Strange Nation: Literary Nationalism and Cultural Conflict in the Age of Poe." He spent four weeks at the Bellagio Center on Lake Como in Italy working on a new book project.

"Writing this book over a period of almost 15 years pushed me to read many new works and totally changed my relationship to my primary field of expertise," Kennedy said. "It was exciting to discover connections and to pull together these chapters on diverse areas of literary activity."

The book grew out of an essay Kennedy wrote on the famous American writer Edgar Allen Poe in 1999. Kennedy said many of the issues and hostilities we see in the current presidential election are deeply rooted in the age of Poe from 1820-1850, which is the book's central focus.

"There is so much anger in contemporary American culture that is rooted in the violent clashes of the antebellum era. 'Strange Nation' looks into the origins of this national hostility," Kennedy said.

The book writing process was daunting at times, Kennedy said. Balancing writing with his teaching duties was tricky, but the classroom lectures "came alive" in new ways when Kennedy began to recognize how literature in the United States was trying to invent the idea of America in the midst of sectional and racial-ethnic quarrels.

The Rockefeller Foundation Bellagio Residency Program offers academics, artists, thought leaders, policymakers, and practitioners a serene setting conducive to focused, goal-oriented work and the unparalleled opportunity to establish new connections with fellow residents from a wide array of backgrounds, disciplines, and geographies. The Foundation's Bellagio Residency Program has a track record for supporting the generation of important new knowledge addressing some of the most complex issues facing our world, and innovative new works of art that inspire reflection and understanding of global and social issues.

The academic writing residency is for university and think tank-based academics, researchers, professors, and scientists working in any discipline. Successful applicants demonstrate decades of significant professional contributions to their field or show evidence of being on a strong upward trajectory for those in their careers.

Kennedy came to LSU in 1973 and has remained on campus ever since, with the exception of one year in France at the Université de Lille as a Fulbright lecturer. He received a Ph.D. from Duke University. Kennedy's research interests are Edgar Allan Poe, Ernest Hemingway, American expatriate writing, and contemporary American short fiction, among other topics.

Kennedy has served as president and vice president of the Poe Studies Association, and he has served as vice president and member of the board of directors of the Hemingway Foundation. He is a past recipient of the Guggenheim Fellowship and the National Endowments for the Humanities Fellowship. In 1981, he founded the LSU in Paris program, and in 1999 was named LSU Distinguished Research Master. ■

GOING THE DISTANCE

Distinguished Research Masters

Since 1972, the LSU Council on Research has presented the university-wide Distinguished Research Master award in recognition of outstanding faculty accomplishments in research and scholarship. The recipients are chosen by the council from nominees proposed by the university community. Each year, one recipient is chosen from the arts, humanities, social sciences & behavioral sciences disciplines, and another from the science, technology, engineering & mathematics—or STEM—disciplines.

Arts, Humanities, Social & Behavioral Sciences

Michelle Zerba, Rhetoric and Classical Studies, College of Humanities & Social Sciences

Michelle Zerba is the Maggie B. Martin Professor of Rhetoric and Classical Studies. She holds a split appointment in the Departments of English and Foreign Languages & Literatures. She also teaches regularly in the Comparative Literature program and at the Honors College, where she recently was awarded the Robert Amborski Outstanding Faculty Award. In 2013-2014, she held the Erich and Lea Sternberg Professorship in the Honors College, and in 2010-2011 she received an ATLAS grant. In 2014, she was a distinguished Visiting Scholar at Columbia University at the Institute for Comparative Literature and Society. Most recently, in 2016-2017, she held a National Endowment for the Humanities fellowship at the American School of Classical Studies at Athens, where she is a senior associate member.

In addition to her many scholarly articles, she has published a book titled "Tragedy and Tragedy" with Princeton University Press. Her book, "Doubt and Skepticism in Antiquity and the Renaissance," was published by Cambridge University Press and was nominated by the press for two distinguished awards in the field of comparative literature. She is currently completing her work as editor of the Norton Critical Edition of Aristotle's Poetics, which is forthcoming in fall 2017. Her recent essay titled "Renaissance Homer: Humanist Learning, the Visual Vernacular and the Socialization of Bodies" will appear in the prestigious journal Renaissance Quarterly this fall. She has a monograph-in-progress titled "Modern Odysseys: Reading Homer with C.P. Cavafy, Virginia Woolf and Aimé Césaire," which has been solicited for publication by Oxford University Press for the Classical Presences series.

Credit: Cody Wilhite, LSU

Left to right: LSU Vice President of Research & Economic Development Kalliat T. Valsaraj, CCT Director J. "Ram" Ramanujam, Rhetoric and Classical Studies Professor Michelle Zerba, and Associate Vice President of Research & Economic Development Stephen David Beck.

Science, Technology, Engineering & Mathematics

J. "Ram" Ramanujam, Division of Electrical and Computer Engineering, College of Engineering

J. "Ram" Ramanujam is the director of the Center for Computation & Technology, or CCT, and holds the John E. and Beatrice L. Ritter Distinguished Professor in the Division of Electrical and Computer Engineering. He received his Ph.D. in computer science from Ohio State University. He joined the LSU faculty in 1990, held a joint faculty position in 2005 and served as the Systems Science and Engineering Focus Area lead in 2011. His research interests include compiler optimizations for high-performance computing, computational science, computer architecture, embedded systems, and hardware synthesis and optimization. He received the National Science Foundation's Young Investigator Award in 1994. In addition, he has received the best paper awards at the 2003 International Conference on High Performance Computing and the 2004 International Parallel and Distributed Processing Symposium for his work with others on compiler optimizations for quantum chemistry computations.

The Distinguished Research Masters award provides winners a salary stipend and the University Medal—the symbol of exceptional academic accomplishment at LSU.

Distinguished Dissertation Awards

Since 1983, the LSU Alumni Association and the Graduate School have sponsored two Distinguished Dissertation Awards. Graduates at any of the three commencements in a calendar year are eligible for nomination. A committee of the graduate faculty selects the winning dissertations.

Arts, Humanities, Social & Behavioral Sciences

Jacqueline Zimmer, Josephine A. Roberts Alumni Association Award

Jacqueline Zimmer's dissertation, "Re-examining and Redefining the Concepts of Community, Justice, and Masculinity in the Works of René Depestre, Carlos Fuentes and Ernest Gaines," explores the relationship between social oppression, mythical notions of national identity and formulations of masculinity in Haiti, Mexico, and the American South. She examines how the authors' representations of racial disharmony, marginalization, and violence function as a critique of colonialism, the mythic multicultural American community, and of "imperialist capitalist hegemonic patriarchy" to paraphrase bell hooks's term.

By using a philosophical model of community to examine how the violence produced by masculine domination serves to distort the dynamics of community formation, she proposes that new formulations of masculinities that challenge patriarchal hegemonic masculinity may foster the development of the sort of community that can better resist totalitarian forces. An awards committee member described her dissertation as "a rigorous comparative examination of literary writings by brilliantly weaving together a sophisticated variety of texts from diverse disciplines: gender studies, political science, and philosophy."

Zimmer received her bachelor of arts degree in political science and philosophy with minors in studio art and French from Michigan State University and her master of arts in philosophy from LSU. She received her Ph.D. in comparative literature with a minor in philosophy from LSU in 2016, directed by Adelaide Russo. After graduation, she worked at the World Health Organization for The Global Fund to Fight AIDS, Tuberculosis, and Malaria.

Science, Technology, Engineering & Mathematics

Kunlin Song, LSU Alumni Association Award

Kunlin Song's dissertation, "Application of Biomass in Nanocomposites and Drilling Fluids," expands the application of biomass as an earth-abundant renewable natural resource.

Credit: Cody Willhite, LSU

Left to right: Professor Qinglin Wu, LSU Alumni Association President Cliff Vannoy, Kunlin Song, LSU Graduate School Associate Dean Sean Lane, Jacqueline Zimmer, LSU Graduate School Dean Michelle Massé, and Professor Adelaide Russo.

Specifically, biomass tar, an inevitable by-product of biomass thermochemical conversions, was converted to porous carbon fibers, or CNFs, with an antimicrobial capability. A new strategy was thus provided for utilizing biomass tar as a low-cost precursor to prepare functional CNFs and reducing environmental pollution associated with direct disposal of tar as an industrial waste.

In addition, Song utilized cellulose nanoparticles, or CNPs, extracted from wood as an environmentally friendly and high performance additive in water-based bentonite drilling fluids. These "nanofluids" had lower solid contents and exhibited improved rheological properties, reduced fluid loss, less formation damage, and more cost-effectiveness compared to traditional drilling fluids used today. An awards committee member commented on the impressive multidisciplinary nature of Song's research, and noted that the work "should have a wide appeal to a variety of scientists, engineers and ecologists."

Kunlin received his Ph.D. in renewable natural resources from LSU in 2016, directed by Qinglin Wu. He received a bachelor of science degree in wood science and engineering from Beijing Forestry University in 2009 and master of science degree in wood science and technology from the Chinese Academy of Forestry in 2012. Kunlin won a prestigious second place Wood Award given to the best graduate research papers by the Forest Products Society in 2015. He is currently working as a postdoctoral research associate at the University of Washington. ■

The Distinguished Dissertation awards recipients receive a monetary gift and a certificate of commendation.

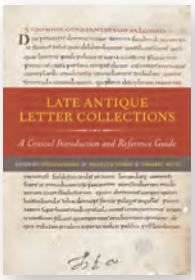
MEDIA SHELF

By Christine Wendling

Birds of Bolivia

Co-authored by J.V. Remsen, LSU Museum of Natural Science Curator of Birds, and **Ryan Terrill**, doctoral candidate

Bolivia is one of the most biodiverse countries in the world and is sixth in the world in terms of diversity of bird species. *Birds of Bolivia* is the first field guide specifically illustrating all 1,425 species of the region. The LSU Museum of Natural Science contains the largest collection of Bolivian bird specimens in the world. Since Remsen began his fieldwork in Bolivia in 1979, he and the museum research staff have contributed 111 bird species to the list of known species from that country. The authors hope that this field guide will increase tourism in Bolivia by encouraging bird-watchers to come and explore. Their goal is to protect endangered species and raise environmental awareness in the region. As such, all proceeds from the book sales will go to Asociación Armonía, the leading bird conservation organization in Bolivia.



Late Antique Letter Collections: A Critical Introduction and Reference Guide

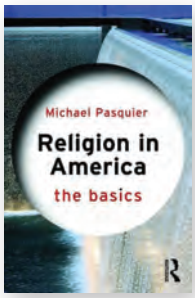
Co-edited by Bradley Storin
Assistant Professor of Religious Studies

Assistant Professor Bradley Storin's academic interest in the literature and religious communities of late antiquity—particularly the letters of Saint Gregory of Nazianus, a fourth-century bishop—are what inspired him to co-author and edit this unique collection of letters. The letters are dated from circa 300-600 C.E. and are Greek and Latin in origin. In each chapter, the authors analyze and interpret a different collection of letters within the context of their respective time periods and social histories. They also analyze how each collection illuminates the writing conventions of the particular letter writer and lend insight into each letter writer's personal agendas and powers of persuasion, based on how they chose to shape their writing.

Neon Visions: The Comics of Howard Chaykin

Brannon Costello
Associate Professor of English

Neon Visions is the first in-depth critical study of a groundbreaking cartoonist who demonstrated that mainstream comic books could be a platform for personal creative expression and thoughtful social critique. In the 1980s, long before graphic novels became a common sight on bookstore shelves, Howard Chaykin pioneered a radical new mode of visual storytelling and infused the heroic adventure tales of monthly comics with a sophisticated – and often controversial – perspective on such themes as Reagan-era politics, the fascist underpinnings of superhero fantasy, and the ways in which popular culture structures our experience of reality.



Religion in America: The Basics

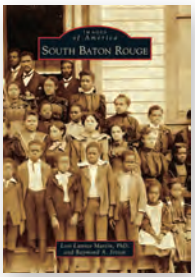
Michael Pasquier
Associate Professor of Religious Studies

Religion in America: The Basics is a concise introduction to the historical development of religions in the U.S. It is an invitation to explore the complex tapestry of religious beliefs and practices that shaped life in North America from the colonial encounters of the 15th century to the culture wars of the 21st century. Far from a people unified around a common understanding of Christianity, *Religion in America: The Basics,* tracks the steady diversification of the American religious landscape and the many religious conflicts that changed American society. At the same time, it explores how Americans from a variety of religious backgrounds worked together to face the challenges of racism, poverty, war, and other social concerns.

Roger Martin du Gard and Maumort: The Nobel Laureate and his Unfinished Creation

Benjamin Franklin Martin
Professor of History

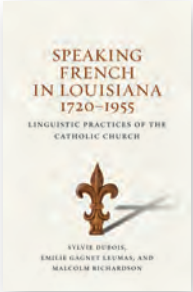
Roger Martin du Gard was a popular novelist of the 1930s and 1940s whose work has been largely forgotten by the modern world. Historian Benjamin Martin reveals that Martin du Gard was a close friend of the French philosopher Albert Camus and a 1937 Nobel Prize winner for his novel series, *Les Thibault*. *Les Thibault* was translated into English and widely popular in Martin du Gard's time. Benjamin Franklin Martin's book explores the themes of the unfinished, less well-known novel, *Lieutenant Colonel de Maumort*, and the author's motives for writing it. In addition to analyzing Martin du Gard's literary achievements, this book delves into Martin du Gard's personal life, including family drama that influenced his writing.



South Baton Rouge

Co-authored by Lori Latrice Martin
Associate Professor of African & African American Studies and Sociology

South Baton Rouge is part of the Images of America series of books by Arcadia Publishing that reveal the regional histories of unique communities across the U.S. South Baton Rouge is a historically significant community where African Americans were allowed to live, work, and learn prior to racial integration. It is home to McKinley High School, the oldest high school established for African Americans in East Baton Rouge Parish. And, the three-square-mile community of South Baton Rouge was the site of the nation's first successful bus boycott. *South Baton Rouge* contains a selection of historic images of the region along with accompanying explanations that contextualize the images and builds a narrative of the growth of the community. The images were collected from individuals in the community and from local libraries in order to tell the story of South Baton Rouge from the perspective of those who live there.



Speaking French in Louisiana, 1720-1955: Linguistic Practices of the Catholic Church

Co-authored by Sylvie Dubois, Gabrielle Muir Professor of French Studies and **Malcolm Richardson**, Taylor Professor of English

Speaking French in Louisiana discusses the history of the French language and culture in Louisiana and its relationship to the Roman Catholic church. This detailed work examines parish baptism, marriage, and burial records, and how language was employed within them. It also analyzes the different approaches taken over time by church administration and local parish priests to reach out to parishioners of various heritages. In the first half of the 1800s, large demographic fluctuations in the state precipitated changes to the church's evangelization practices in which they eventually embraced French/English bilingualism to appeal to the wider community.

The Battle of New Orleans in History and Memory

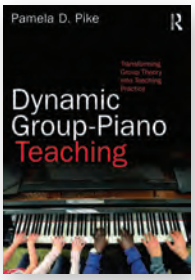
Edited by Laura Lyons McLemore
LSU Shreveport Associate Curator and Archivist

The Battle of New Orleans proved a critical victory for the U.S., a young nation defending its nascent borders, but over the past 200 years, myths have obscured the facts about the conflict. In *The Battle of New Orleans in History and Memory*, distinguished experts in military, social, art, and music history sift the real from the remembered, illuminating the battle's lasting significance across multiple disciplines. Laura Lyons McLemore sets the stage by reviewing the origins of the War of 1812, followed by essays that explore how history and memory intermingle. Other contributors unpack the broad social and historical significance of the battle, from Gene Allen Smith's analysis of Black participation in the War of 1812 and the subsequent worsening of American racial relations, to Blake Dunnavent's examination of leadership lessons from the war that can benefit the U.S. military today. Finally, Tracey E. W. Laird analyzes variations of the tune "The Battle of New Orleans," revealing how it has come to epitomize the battle in the collective memory.

The Golden Band from Tigerland

Tom Continé
Founding Director of Andonie Sports Museum
Faye Phillips
Former Associate Dean of LSU Libraries

Well over a century has passed since two cadets of the Ole War Skule decided to create a brass band for their university, beginning a tradition that continues to the present day. World renowned for its commitment to excellence, LSU's Golden Band from Tigerland celebrates the sports endeavors of the school teams, creates pride in school traditions, and entertains millions of fans every year. This beautifully illustrated history of LSU's beloved marching band moves from its military inspiration through the directorships of Castro Carazo, William F. Swor, and Frank B. Wickes to the first female drum major, Kristie Smith, in 1999. Tom Continé and Faye Phillips highlight the band's recent triumphs as well, including the Sudler Trophy awarded by the John Philip Sousa Foundation; induction into the Louisiana Music Hall of Fame; and traveling abroad to march in Hong Kong's Chinese New Year celebration and Dublin's St. Patrick's Day Parade. The excitement of the Pregame Salute, the triumphant spirit of the halftime show, and the hard work that goes into the performances are all captured in 150 photographs. Above all, *The Golden Band from Tigerland* serves as an enduring tribute to the generations of LSU students whose talent and energy transformed a small brass group into an acclaimed marching band.



Dynamic Group-Piano Teaching: Transforming Group Theory into Teaching Practice

Pamela Pike
Aloysia L. Barineau Associate Professor of Piano Pedagogy

Dynamic Group-Piano Teaching provides future teachers of group piano with an extensive framework of concepts upon which effective and dynamic teaching strategies can be explored and developed. Within 15 chapters, it encompasses learning theory, group process, and group dynamics within the context of group-piano instruction. This book encourages teachers to transfer learning and group dynamics theory into classroom practice. As a piano pedagogy textbook, supplement for pedagogy classes, or resource for graduate teaching assistants and professional piano teachers, the book examines learning theory, student needs, assessment, and specific issues for the group-piano instructor. ■

Credit: LSU

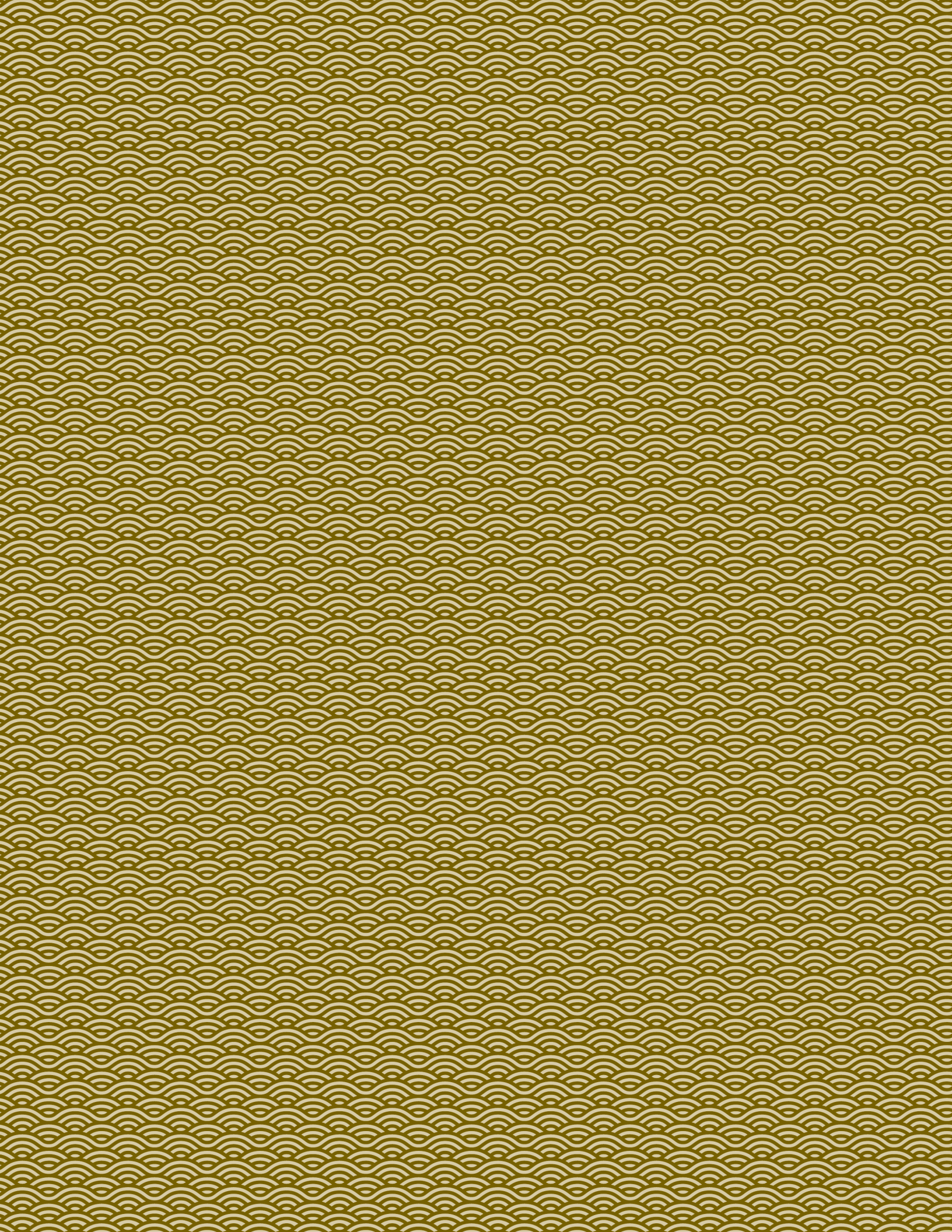
About the LSU Office of Research & Economic Development

The Office of Research & Economic Development, or ORED, is responsible for supporting and promoting the research enterprise at LSU.

Our mission is to support a holistic, university-wide environment in which advanced research, effective scholarship, and economic development can thrive and support the LSU Strategic Plan 2025.

We support this effort through strategic planning, development of workshops, support for pre-award grant services, public engagement, compliance oversight, and other research administration. Our research focal areas outline seven interdisciplinary research topics that we support with coordinated grant writing and initiatives.

For more information, visit **LSU.edu/research** ■



Office of
Research & Economic Development

Louisiana State University

134 David Boyd Hall • Baton Rouge, LA 70803

LSU Research is published annually by the Office of Research & Economic Development at Louisiana State University. For more information, visit: **www.LSU.edu/research**.